AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

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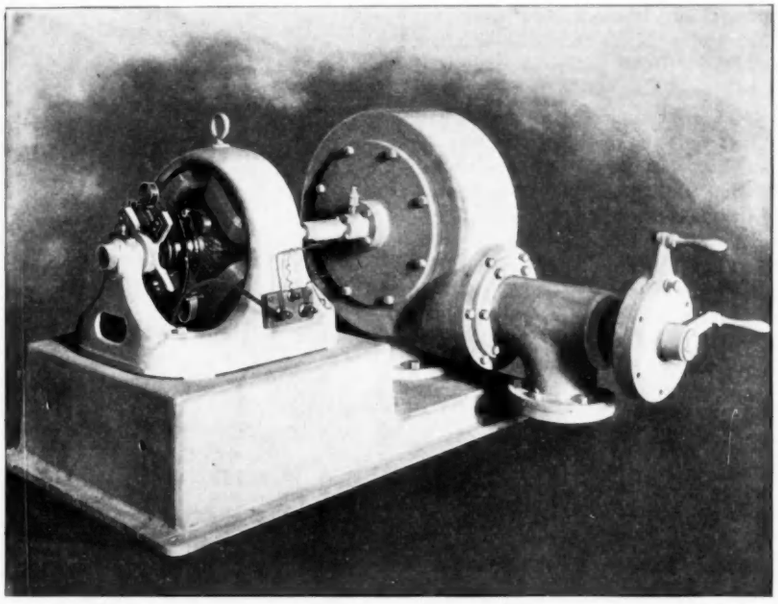

LIGHTING A PUMPING STATION BY WATER POWER.

Lighting a Pumping Station by Water Power.

The letter which we print herewith relates to a practice which we believe to be new and which has much to commend it. Its principle is the use of water from a steam-pumping station as power water for lighting the station. The economy of the plan over a separate small engine for driving the dynamo is obvious. If the water wheel has an efficiency of 85 per cent., which can easily be reached in moderate-sized wheels of the impulse type. the plan secures a coal economy, for lighting, of 85 per cent. of that obtained by the pumping engine, which latter, being of large size, and of high grade, gives a resulting economy far in excess of what could be secured by any small engine driving the dynamo direct.

The half-tone general view gives an excellent idea of the general arrangement, and the sectional sket h of the nozzle, Fig. 2, shows the method of adjusting the discharge of water to the work. This plan is, of course, far more economical of water than a single large nozzle with throttling-gate regulation could be. The handle *a* of Fig. 2 adjusts the nozzle to position and *b* binds it there. An index plate and pin will be seen in the half-tone, the purpose of which is to insure the correct placing of the nozzles with respect to the wheel. The impulse type of wheel has peculiar advantages for this class of work, in which the speed of the wheel must be the same as that of the machine to be driven. With a turbine, a change in size ordinarily changes the power delivered as well as the speed, and it is only by chance that a standard turbine wheel can be found to fit any given case in both speed and power. With the impulse wheel, on the other hand, the diameter can be varied at will without changing the power delivered, so long as the nozzle remains unchanged, and in proportioning wheels for this class of work it is only necessary, in ordinary cases, to make the wheel of such diameter that when running at the number of revolutions required by the machine to be driven it shall have a peripheral speed equal to that called for by the head of water under which it operates.

The Jas. Leffel Company informs us

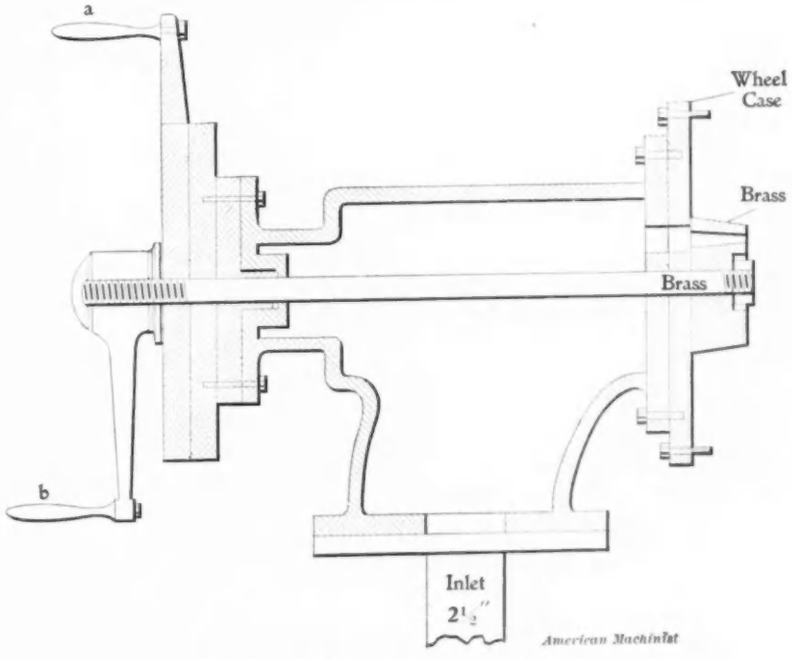

FIG. 2.—SECTION OF GATE AND NOZZLE.

that the success of this plant has led to the installation of a similar one, but of about three times the capacity, at the Columbus, Ohio, water works. The letter is as follows:

Editor American Machinist:

There has been no undertaking in my past experience that has given more satisfaction than this, and, in fact, it exceeds our expectations as to economy. As we were too far from the city electric plant to receive light from them, we concluded to put in a plant of our own, and purchased a 40-light machine, which will easily carry 50 lights, and connected it direct to a 12-inch Leffel Cascade wheel, which is connected to our main service-pipe inside the station. The discharge is piped to pump well to obviate any waste of water. Under 70 pounds pressure, our minimum, we can run 30 lights 16 c. p., 110 volts, with 21-32-inch jet, which gives a theoretical flow of 90 gallons per minute, making a total of 54,000 gallons in 10 hours' run, which actually costs 23 cents per thousand gallons for coal burned while pumping, as all other items, such as salaries, banking fires, etc., remain a constant, showing the exact cost to us of running 30 lights 10 hours to be 12.42 cents. Our coal costs us $1.75 per ton, delivered in shed at station. The data are based on my last year's report of the triple-expansion pumping engine.

The Cascade motor has five different size jets—5-16-inch, 9-16-inch, 21-32-inch, 11-16-inch and 23-32-inch in diameter, made on the smooth taper plan. The nozzles are all in one brass disk, 4 inches thick, bored longitudinally, the disk being 5 inches in diameter. The jets are laid off on a circle having six spaces, one being left blank to close main opening when not in use. I inclose rough sketch to give a better idea. The generator was built by the Triumph Electric Company, of Cincinnati, Ohio. It is a multipolar, compound, shunt-wound machine, the speed being 890 turns per minute.

W. C. POWELL,
Engineer Springfield, Ohio, Water Works.

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England's Competitors.

In advance proofs of an article by Joseph Ackland on "British Trade," published in "Sell's Register," we find the following:

"It is now more than nineteen years since Mr. Gladstone, in the 'North American Review,' drew attention to the competition to which the industry and manufactures of Great Britain would be subject in the future from America, and warned his countrymen to prepare for the inevitable loss of the first place in the markets of the world. More recently much has been said and written about the efforts which Germany has made to rival British enterprises. It is from these two nations that our severest competition will come, has indeed already come, and we must closely watch what progress they make. One important element in industry is population; in this respect both Germany and the United States are in advance of the United Kingdom, and are likely to increase their superiority—the United States very extensively. * * * It must, in conclusion be recognized that British trade will not forever maintain the supremacy it now holds. Competition will continue, will increase; it may be that the enterprise and determination of the British race for a generation or two yet will be able to keep the first place; but, however long the event may be deferred, it is inevitable that the United States, if they maintain peace, and adopt a sound economic policy, must come to the first place. Germany will doubtless continue to develop her resources, but there is no sufficient reason for fearing that she will ever surpass Great Britain. Germany has many drawbacks, arising from her Continental position and perils, her military system, her few and feeble colonies, to weight her in the race. With her own success will come an accession of labor troubles, and of higher wages, which will deprive her of some of the advantages she now enjoys in the production of cheap goods.

"Whatever be the issue, British manufacturers and merchants will now, as ever, brace themselves to the conflict, with the same courage and determination as animated their forefathers who gained and handed down this priceless heritage."

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Frictional Losses in a Hydraulic Intensifier.

BY WALTER FERRIS.

The following experiments were made in October last at the Pencoyd Iron Works, with the idea of getting some definite information as to the frictional losses in hydraulic machinery in general, and to see to what extent the formulas given by engineering authorities correspond with our practice. Incidentally, also, it was desired to find out whether our constant use of intensifiers to raise the pressure at certain machines is causing a heavy loss in efficiency.

Concerning the frictional losses in the stuffing boxes of hydraulic rams, I find the following rules given by high German authorities as the result of experiments. The "Taschenbuch der Hütte" says (15th edition, vol. 1, p. 202): "For stuffing boxes with hemp, cotton or leather packing, with water pressures between 1 and 50 atmospheres, the frictional loss is dependent upon the water pressure, the *circumference* [or diameter] of the packed surface, and a coefficient μ, which is constant for this range of pressure. The loss is independent of the *depth* of stuffing box or leather ring, as the case may be, and is given by the formula:

(1) $F = K \times p \times D$ in which:
F = total frictional loss in pounds,
p = pressure in pounds per square inch,
D = diameter of plunger in inches.

K is a coefficient, which depends on the kind and condition of the packing, and is given below for various cases.

(*a.*) For cotton or hemp, loose or braided, dipped in hot tallow; plungers smooth, glands not pulled down too tight, packing therefore retaining its elasticity; dimensions such as usually occur.

$K = .072$.

Same conditions, after packing is some months old (!)

$K = .132$.

(*b.*) Materials the same, but with hard packing, unfavorable conditions, etc.

$K =$ as much as .299.

(*c.*) Leather packing; soft leather, well made, etc.

$K = .036$ to $.084$.

Hard, stiffly tanned leather.

$K = .12$ to $.156$.

Unfavorable conditions; rough plungers, gritty water, etc.:

$K =$ as much as .239.

From Weisbach-Hermann's "Mechanics of Hoisting Machinery" (Macmillan & Co., 1893, Tr. by K. P. Dahlstrom) is taken the following formula for frictional loss of a plunger working in leather packing:

$$(2)\quad F = \mu \frac{P}{D}$$

in which:
F = total loss of pressure in pounds
P = total pressure on plunger in pounds.
D = diameter of plunger in inches
μ = a coefficient, ranging from .0398 to .0977.

This formula is easily reduced to the same form as that given in Eq. (1), as follows:

Let p = pressure per square inch.

(3) Then $P = \frac{\pi}{4} D^2 p$, and substituting this in Eq. (2) we have

$$(4)\quad F = \mu \frac{\pi}{4} p D.$$

But μ is given as .0398 to .0977. Therefore $\frac{\pi}{4} \mu = .0312$ to $.0767$, and we have

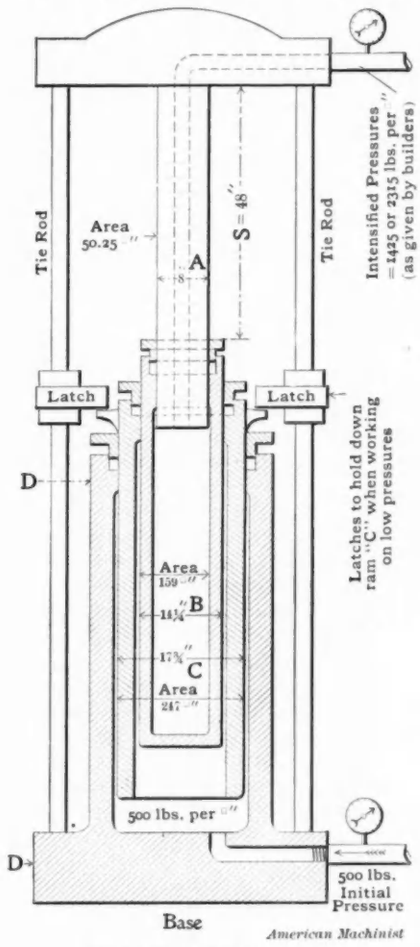
$$(5)\quad F = .0312\, p\, D \text{ to } .0767\, p\, D.$$

This is seen to be substantially the same formula as is given in Eq. (1) from the "Taschenbuch," and on comparison with case (*c*) under Eq. (1), the values of the coefficients for leather packing are seen to agree substantially, assuming that Weisbach also meant these values to apply to soft leather—the values given by Weisbach being about one-third higher than those given in the "Taschenbuch" for soft leather, and only about one-quarter of those given for hard, stiff leather (.12 to .156).

The experiments referred to were made to determine to what extent the

formulas given by the best authorities correspond to actual experience at Pencoyd. It will be noticed that for hemp packing three conditions are given, the coefficients for which are .072, .132 and .299. I shall assume that for the condition of packing in actual use the coefficient should lie betwen the extremes, and use .20—that is:

(6.) $F = .2\ p\ D$ for braided hemp packing, compressed rather hard in stuffing box, with lubrication and plunger



HYDRAULIC INTENSIFIER.

surface fair. In the following table, the actual losses of pressure observed in the operation of an intensifier are compared with the losses which the formula gives for the same conditions of pressure.

As the intensifier may not be familiar to all readers, I will describe the sketch of it given in Fig. 1. It consists of a stationary cylinder D, resting on a base, from which tie rods extend upward and unite the cylinder D to the inverted ram A, also stationary. D is provided with an inside stuffing box, and sliding within it is a ram C, which is also bored out and furnished with a similar hollow ram B sliding within itself. B, like the others, is bored out, and has a stuffing box around the stationary ram A. Into the bottom of the machine is introduced water under a comparatively low pressure—in this case about 500 pounds. This causes the rams C and B, or B alone (as will be explained later), to rise, and the water contained in the closed interior of ram B is forced up through the hole in the center of ram A with a greatly increased pressure, depending on the ratios of areas of ram C to ram A, or ram B to ram A, as the case may be, and also upon the frictional losses in the two stuffing boxes. After the stroke is made and the shear or punch which is driven by the intensifier is ready for its back stroke, the 500 pounds water is released from the base, and the rams drop back to the bottom ready for another stroke. It will be noticed that ram C is provided with a pair of retaining latches to hold it down. These are to be used in cases where the intensified pressure given by the low pressure water acting on the whole area of C would be greater than necessary, and would only result in waste of water. When the work to be done is light, C is held down, and acts as a cylinder itself, with B as the ram. In these experiments the intensifier was doing its usual work in driving a shear, cutting 12-inch and 10-inch I beams and channels. The rams were run very slowly, to avoid the effects on the gages of jars and velocity of water in pipes.

To apply the formula of Eq. 6 ($F = .2\ p\ D$) it is necessary to use it twice, as the total loss due to friction consists of two parts—a loss in the low pressure stuffing box and another in the high pressure stuffing box. As it is rather slow and confusing to apply the formula twice, I will give a transformation of it which is better adapted to our use, and which gives the final (intensified) pressure at once. Any readers who do not care to bother with the algebra, and will take the result on faith, need only read the notation given here and skip to Eq. (9):

Let D and d be the diameters, and A and a be the areas of large and small rams; P_1 and p_2 the initial and intensified pressures per square inch, and F_1 and F_2 be the two parts of the total loss of ram force due to friction.

Then from Eq. (6)—

$F_1 = .2\ p_1\ D$, and

$F_2 = .2\ p_2\ d$, or adding

(7) $F_1 + F_2 = .2\ p_1\ D + .2\ p_2\ d$.

But it is clear that if there were no friction the intensified pressure would be

$$p_2 = \frac{A}{a}\ p_1 \text{ per square inch,}$$

and that in the actual case, the loss *per square inch* on the small ram due to friction will be the total loss in both rams divided by the area of the small ram, or

$$\frac{F_1 + F_2}{a}$$

Hence, actually

$$p_2 = \frac{A}{a}\ p_1 - \frac{F_1 + F_2}{a}$$

(8) or $F_1 + F_2 = Ap_1 - ap_2$.

	Exper. No. 1.	Exper. No. 2.	Exper. No. 3.	Exper. No. 4.
(1) Diameters of rams	14¼" and 8"	14¼" and 8"	17¼" and 8"	17¼" and 8"
(2) Actual initial pressure	285	475	335	350
(3) Actual intensified pressure	750	1450	1450	1510
(4) Intensified pressure given by builder for 500 pounds initial	1425	1425	2315	2315
(5) Intensified pressure builder would expect from actual initial	813	1354	1552	1620
(6) Intensified pressure, if there were no friction, from actual initial	905	1505	1650	1725
(7) Ratio $\frac{\text{Area first ram}}{\text{Area second ram}}$	3.17	3.17	4.93	4.93
(8) Ratio given by builders for $\frac{\text{Intensified pressure}}{\text{Initial pressure}}$	2.85	2.85	4.66	4.66
(9) Ratio by experiment for $\frac{\text{Intensified pressure}}{\text{Initial pressure.}}$	2.63	3.06	4.34	4.31
(10) Efficiency of machine, estimated by builders $\left[=\frac{(8)}{(7)}\right]$	.90	.90	.945	9.45
(11) Efficiency of machine given by experiment $\left[=\frac{(9)}{(7)}\right]$	.83	.905	.88	.875
RESULTS BY FORMULA :				
(12) Intensified pressure, p_2 (Eq. 9)	860	1431	1572	1643
(13) Ratio given by formula for $\frac{\text{Intensified pressure}}{\text{Initial pressure}}$ $\left[=\frac{(12)}{(2)}\right]$	3.02	3.02	4.70	4.70
(14) Efficiency of machine by formula $\left[=\frac{(13)}{(7)}\right]$	.953	.953	.953	.953

Now equating the second members of (7) and (8)

$$.2\,p_1\,D + .2\,p_2\,d = Ap_1 - ap_2, \text{ or}$$

$$(9)\quad p_2 = p_1\,\frac{A - .2D}{a + .2\,d}$$

This gives at once the intensified pressure which may be expected from any intensifier when the initial pressure and dimensions are given; or if these pressures be assumed, it will give the ratio of ram areas. Of course the coefficient of frictional loss (in this case .2) must be assumed.

The results in item (12) of table are taken from Eq. 9, the value of p_1 being that actually used in the experiment, taken from item (2) of table. It will be noted that the formula gives an efficiency of .953 in all cases (item 14), while three of the experiments gave efficiencies much below this, and one was above (item 11). The low efficiencies by experiment were in all cases attended by low initial pressures (item 2), which calls attention to the importance of always using as small a driving ram as possible. If the packing is pulled down to be tight at a pressure of, say, 500 pounds, an amount of friction is caused which is not needed for pressures of 285 or 335 pounds, and we lose not only the work due to choking the water in the inlet valves from 500 to 285 pounds, but a greater fraction of what is left is used up on friction.

The general result seems to be that the formula is good, as indicating the most efficient performance of a given machine. Due allowance must be made for the fact that the machine is often used under conditions of low efficiency, while the formula assumes that the packing is only pulled tight enough to prevent leakage. The possible efficiency of intensifiers seems to be high, and it is probable that much less loss attends their use than would be incident to carrying a pressure unnecessarily high for the larger part of the work to be done in the plant.

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Compressed Air Explosions.—A Recent Typical Explosion.

BY FRANK RICHARDS.

The fact that steam boilers explode is not in these days cited as a reason for abandoning the use of steam, and the fact that explosions have occurred in connection with the use of compressed air does not constitute it a legitimate weapon for the alarmist, or furnish any reason for avoiding the employment of compressed air for the uses to which it is specially adapted. There is and there can be no means of power transmission that cannot be made dangerous. If force can be applied it can also be misapplied. The use of compressed air in considerable volumes and under high pressures is quite recent, and at the beginning there has been naturally a time of more or less ignorance, in which some dangerous conditions have been permitted to occur, and in which and by which valuable experience has been accumulated. In the case of compressed air this period has been a much shorter one than in the case of steam, for instance. We have progressed even now far enough to make it proper to say and to maintain that the conditions under which explosions of compressed air mixed with oil vapors occur are so well known that those who to-day permit them to exist must be more or less liable to the reproach of not knowing what they might and what they should know, or to the charge of not appreciating or of not fulfilling their responsibility in the matter.

As with the freezing up of compressed air, or rather with the choking up of the exhaust passages by accumulations of ice, which involves the concurrence of two distinct conditions, the sufficiently low temperature and the presence of moisture in the air, so explosive mixtures can only be formed and explosions of them can only occur where there are at once the two conditions of high temperature and of vaporized oil in sufficient quantity, or of oil that may be volatilized by and mixed with the heated air. These conditions of danger being understood, it should be a simple thing to prevent their simultaneous presence.

It must be acknowledged that there is here in some cases a temptation to run a risk. Economy of power in air compression requires that the compression be done by stages, with efficient intercooling, and in this way high and dangerous temperatures are avoided. A single stage compressor is simpler and cheaper, and, especially for temporary plants, may seem to be preferable, and when adopted it may involve, especially when recklessly run, the danger of excessive temperature and of oil suspended in the heated air and consequent explosions, and, as I have said before, the typical cases of explosion have been chiefly of this character, but where they have been permitted to occur, or where they should now be permitted to occur someone has been or would be to blame.

Even in cases of single stage compression up to seven or eight atmospheres, where the temperatures reached by the air are high enough to cause ignition, the danger is largely contingent upon the manner in which the lubricating oil is fed to the cylinder. If the oil is fed continuously drop by drop the danger is not so great as when the same total quantity is fed intermittently. In the first case the lubricating effect will be better, and the volatile portion of the oil will mix with the air and be carried along without at any time forming a mixture sufficiently rich to be explosive. But if the oil is dumped into the cylinder by the teacupful, or something like that, as in aggravated cases it sometimes is, all the necessary conditions would seem to be present, and it should not be wondered at if an interesting explosion should occur, and then someone or something other than compressed air in general should be blamed for it.

In single stage compressors working to seven or eight atmospheres, and where the temperature of the air as it passes out of the compressing cylinder will exceed 400 degrees Fahrenheit, there will be, with either style of feeding the oil, an accumulation of residuum in the passages which in time must materially reduce their area. It is wise, therefore, to make all such passages large, and also necessary at times to clear out the obstruction.

The article which the "American Machinist" reproduces from "Glückauf" would be worthy of more consideration if the compressor employed in the experiments narrated had been more correctly designed. The long and extremely small air passages for the discharged air were an absurdity, and by their rapid choking up introduced another element of danger which could have been easily avoided. The additional heating up of the air by its friction when already so hot was a needless exasperation.

I have spoken thus far of the dangers which the ill-designed or the ill-managed compressor may invite, and, as a matter of fact, most of the explosions which have occurred have been, as far as I know, at or near the compressor, and have been caused somewhat in the way that I have indicated. The contribution of Mr. Wm. E. Gibbs in the "American Machinist" of January 13 tells of an extremely forcible explosion with which the compressor had nothing to do, yet which resulted from the same conditions of very hot air, in this case also at very high pressure, and a plenty of oil. There was a long, depressed run of pipe, filled with air, presumably at normal pressure and temperature, and there was a lot of oil which had accumulated there on account of the dip. Air at 1,700 pounds was suddenly turned on to this pipe, the inclosed air was compressed and intensely heated, the oil was vaporized and mixed with the air and exploded with such force as to burst the pipe which had been tested to a pressure of 6,000 pounds per square inch. This trick might be played with compressed air in many cases, if the possibility of it was not guarded against, and if the possibility had not been thought of. Probably by some engineers it has not even yet been independently thought out, so that the publication of the incident is a public service.

It is probably very certain that a similar incident could not occur again in any compressed-air plant that might be in charge of Mr. Gibbs. So in the installation of a compressed-air plant upon a United States ship of war, the contemplation of the possibility of which suggested

the present discussion, it may fairly be assumed that there would be in those in charge sufficient knowledge to render the possibility of danger an unwarrantable suggestion.

It may be considered something of a coincidence that at this exact time, and, in fact, since the above was written, there has occurred right here in New York a typical explosion of the class which we are considering. There was first the lack (in this case certainly not culpable) of accurate knowledge as to the danger of the conditions which were permitted to occur, and then there were the conditions in detail, the compression of air to a high pressure and the consequent high temperature, the presence of sufficient oil to form an explosive mixture, and then the almost inevitable ignition and explosion, with the death of two men as a consequence. The accident did not occur in connection with the regular or legitimate use of compressed air, and no persons familiar with compressed-air practice had anything to do with the matter. It was in a brewery, where it had been the custom, after overhauling or repairing the ammonia compressors, to pump up with air to a considerable pressure to see that the joints were all tight before recharging with ammonia, and this operation was undertaken in this case. It was not supposed to be a test of the strength of the pipes or other parts, as they were amply strong. The usual working pressure for the ammonia was about 180 pounds, while the air test was carried higher than that, 300 pounds having been frequently applied. The explosion occurred at a pressure below 240 pounds. Pieces of the cast-iron pipe flew in various directions, one piece striking the engineer, who was only three or four feet away, another piece hitting another man at a distance of thirty feet or so. Both men were killed. All the windows of the engine room were blown out, and a large surface of the ceiling was blackened by the exploded charge. The still attached portions of cast-iron pipe, which was perhaps 5 inches in internal diameter, were about 1¼ inch thick, of good sound iron, and I have no doubt would have been safe at 1,000 pounds pressure.

The reason of the explosion is self-evident. The air was intensely hot and there was enough oil present to make an explosive charge. That an explosion had not occurred on some previous "test" was simply because the conditions had not concurred. It is to be supposed that the oil had not been present in sufficient quantity, for it is not likely that the air temperature was lacking.

Occurrences such as this demonstrate, of course, the necessity of disseminating as widely as possible the knowledge of the conditions to be avoided. They do not in the least militate against the proper use of compressed air.

Universal Sawing Machine.

We present herewith engravings giving a general and some detail views of a new sawing machine which is especially adapted to pattern makers' use and in the packing department of machine shops, etc.

The machine is adapted to carry both a cross-cut and a rip saw, and either of these can be brought as much above the table as may be desired and held there by means of the worm and wheel shown, and without stopping the machine.

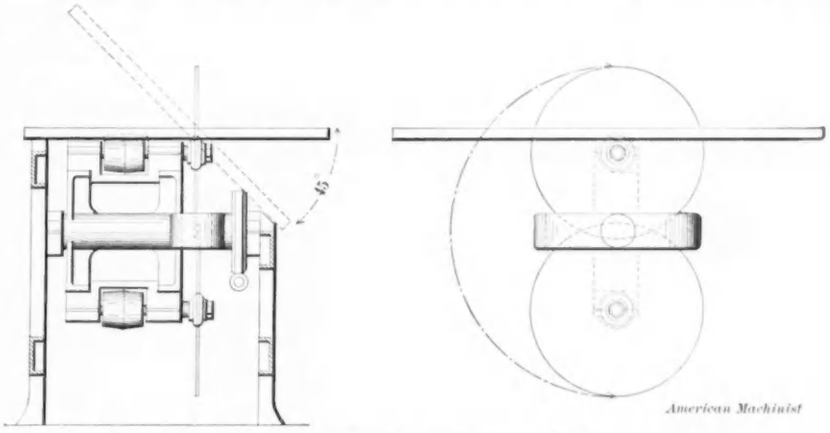
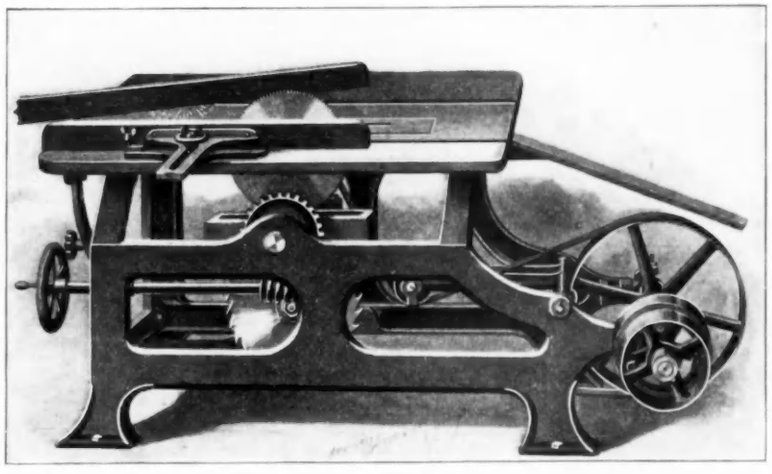


DIAGRAM SHOWING ARRANGEMENT OF SAWING MACHINE.



UNIVERSAL SAWING MACHINE.

The table tilts to any desired angle, as shown, and the arrangement of the revolving frame which carries the saw across is such that it is supported in both sides of the main frame; and, owing to the fact that the saws can overlap each other, larger saws can be used than possible where a shaft passes between them.

The countershaft is part of the machine, and the belt-tightener shown maintains the proper belt tension.

The machine is built by the Bentel & Margedant Company, Hamilton, Ohio.

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A franchise has been granted to Thomas A. Quill for laying pipes for supplying compressed air in Cincinnati.

Shop-Eye-Doctors' Tools.

All machinists recognize the very great advantage of having the best possible tools for their work, and Mr. C. A. Barrett, a machinist, whose address is 758 Bellfort avenue, Oak Park, Ill., has applied this principle to the work of the shop eye doctor. Mr. Barrett supplies at small cost a kit of tools consisting of a rubber-handled instrument, in one end of which is a strongly magnetized piece of steel wire, formed so as to be brought into contact with the eye-ball if necessary without injury, while in the other end is a piece suitably formed for removing foreign substances that have become imbedded in the eye; a pair of finely pointed spring tweezers and a small bottle of a soothing eye water, with medicine dropper. These are all inclosed in a wooden mailing tube, with screw top, which forms a case in which the kit can be conveniently kept when not in use. If we were to offer a suggestion it would be that some form of implement to hold the eyelid open and a watchmaker's eyeglass of about 3-inch focus be added; but the kit as it is is very much superior to the frazzled end of a pine stick.

Accurate Screw Machine Work.—Screw Cutting.

BY J. O. SURFACE.

While screw machines are used to produce about every conceivable thing in the shape of round or turned work, the larger part of them are used for threading screws of some form or other, and probably no other kind of work on a screw machine is so poorly done or so unsatisfactory as the threading.

Threads generally are rough and ragged, uneven or tapering in size and are not correct in lead. It is the purpose of this article to show some methods and

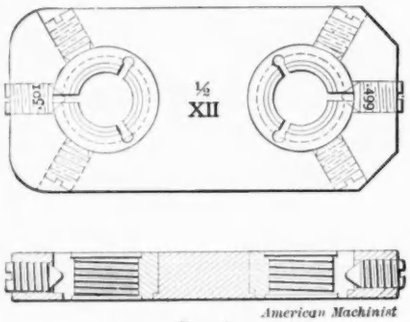

Fig. 1

LIMIT GAGE FOR SCREWS.

tools by which these difficulties may be overcome.

Size is, of course, most important, and for this some kind of testing tools are required. Often a nut is used or a scrap piece is tapped out, but these are likely to vary by wear or be lost, and for high grade work good hardened gages should be provided. The limit variety marked "go in" and "not go in" is the best, for, by their use, nothing is left to the judgment of the operator, which would vary widely in different men, as some would have very elastic judgment and say pieces were good enough when a limit gage would show they were not up to the required standard.

With limit gages the screws are at once shown to be either good or bad. Fig. 1 shows a good form often used and thoroughly reliable. One end has round corners, the other end has them beveled, and by always marking the large end with reference to these shapes, the work-

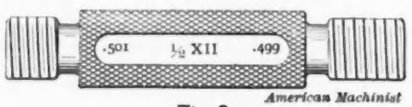

Fig. 2

STANDARD FOR SETTING GAGE.

man can know at a glance, when he picks up a gage, which end is the larger.

A limit of .002 inch, or, .001 inch above or below a given size, gives a fair working limit, and in nearly every shop would be called first-class work.

The plugs, Fig. 2, for setting the test tool are usually left soft, as they should not be used for other purposes, and the wear is slight, and hardening might change their size. In making these plugs the old way of turning to the correct outside diameter and then cutting the thread till the tops are sharp is hardly satisfactory. They should be measured on the V or pitch line measurement. Micrometer calipers for this purpose are easily obtainable, and if the taps are made or ordered by the same measurement (as many now practice) good fits are assured.

As screw blanks are usually turned from .001 inch to .005 inch or more small before threading to avoid roughness or tearing the tops of the threads, these threaded plugs for setting the limit gages should also be the same amount small; otherwise after the gage is worn so the spaces are wide, a screw which was small outside diameter could go into the test tool which would not measure correctly with a micrometer and would not fit a standard hole.

With just the right conditions it is easy to cut smooth threads, but many times these points are overlooked and poor work is laid to the dies, when, if all other conditions were correct, the dies would cut smoothly.

Slow speed and ample lubrication are essential for good work. The surface speed on soft steel or iron should not be over 20 feet per minute for standard threads, but can be somewhat higher for finer pitches.

As the turning and cutting off tools can do as good or better work at higher speed it is often the practice to shift the belt on the cones between the turning and threading, but this takes time and is hard on belts, even with a belt shifter on the cones. A better way is to use three friction pulleys on the countershaft. One running the spindle forward the correct speed for turning—about 40 superficial feet per minute—another running forward at half the speed for threading and the third to run backward as usual. These can all be operated with one shifter by several methods. Fig. 4 shows one very good plan of carrying this out. The long thimble starts the shaft with the slow pulley, and to run fast the long thimble is pushed further in, releasing that pulley and connecting the other forward pulley which runs fast. Nothing is quite so good for threading as good lard oil. Soda-water compounds are good for milling machines or drill presses and for some turning, but on threading steel they do not give satisfactory results, the threads are torn and the dies short-lived. Some other oils give fair results, though not as good as lard, and mineral oils are little better than water.

The oil should be forced on in a large, steady stream. Dropping from a can is not sufficient, for we need not only to lubricate the cutting edges, but to force on the oil rapidly enough to carry the heat away from the extreme cutting edge; for it is the heating of this edge which causes it to dull rapidly, and the oil will also carry away the chips.

For some classes of work opening dies can be used with some saving of time, and sometimes making better threads;

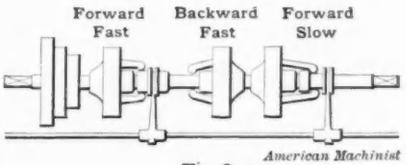

Fig. 3

COUNTER-SHAFT.

as often the chips wedging in or undue pressure in running off a die injures a thread which was cut smoothly. But after having tried many opening die-holders I have yet to find one which will cut continually, both in size and leads, to the degree of accuracy which is called for by the best machine-tool builders.

One trouble with most opening die-holders is they are held rigidly in the turret, and if the machine is out of perfect alignment one tooth of the die will cut more than the others and cut the work small. A die-holder should either be slightly free to adjust itself or capable of being adjusted central.

Some prefer a die of the hollow-mill variety, and it has the advantages of the oil readily reaching the cutting edges and the chips dropping away freely. Also, they can be readily sharpened by

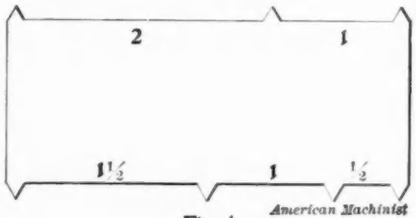

Fig. 4

TESTING TOOL FOR SCREWS.

grinding on a thin wheel, but they are more likely to cut tapering, and cannot be as easily corrected for lead as the flat die, which is mostly largely used, and is made by about every manufacturer of taps and dies.

If a die does not cut smoothly, or if it has become dull, it can be sharpened by breaking apart and grinding the cutting edges on a thin emery wheel; but a better method is to lap the cutting edges by using a wire or rod in the side holes of the right diameter to touch the cutting edges. Run the rod in a speed lathe and use No. 120 emery. A few minutes' work will help a new die, as any edge needs grinding or stoning after hardening, and worn dies can be much improved.

Though screws in which the lead is not correct are often used, there is hardly anything more annoying than to start a screw into a hole too loose, and, after a few turns, find it binds and will go no further,

even though it fitted the limit test tool for size, because the test tool was thin. Screws are often called tapering when they appear so only because the lead is incorrect. If any attention is paid to this they are usually measured with a scale, in the usual way; but as the tops of the threads are not sharp, the inaccuracy is not easily discerned, and unless the scale is placed perfectly parallel with the center of the screw this measurement is misleading.

An inexpensive test tool which is better than a scale is shown in Fig. 4. The V points are ½ inch and multiples, of ½ inch apart and fit into the thread. But this has the same objection as a scale, in that it may not be just on a parallel with the screw, and it does not show how much the inaccuracy really is, which is necessary to secure uniform results.

Fig. 5 shows a test tool by which the lead is measured correctly and the amount of variation shown. The screw to be measured is placed in the large V block and pushed against the stationary and sliding V points; and, as the long end of the indicator multiplies many times, it reads the variation in thousandths either above or below standard; one side shows the variation in ½ inch for short screws and the other in 1 inch for longer and larger sizes.

A fair practice is to pass screws which do not show over .005-inch variation above or below standard in 1 inch and condemn all others. A reference test for correcting wear on this test tool can be made by turning 3 V grooves in a plug ½ inch and 1 inch apart. But to overcome this trouble is more difficult than to detect it. Some dies will at once cut correctly and others insist on going wrong. This may be caused by incorrect hobs or changes in hardening, or their not being held properly on the different lands; so that in the case of a four-tooth die all the teeth do not cut equally.

Sometimes the attempt is made to correct the lead by holding the die back or helping it ahead, as the screw may be long or short; but this is unsatisfactory, as the pressure cannot always be the same.

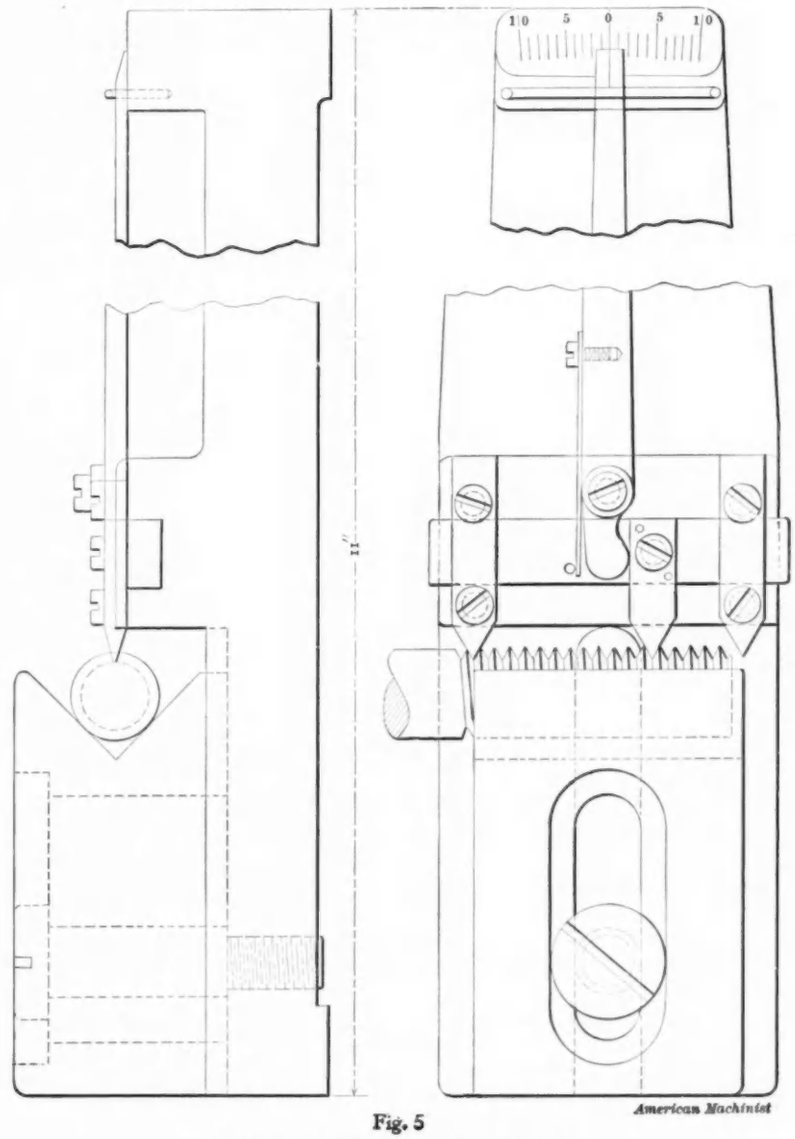

Fig. 5

TOOL FOR TESTING PITCH OF SCREWS.

Fig. 6

FLAT DIE FOR SCREW MACHINE.

Usually the dies are made with a hob near enough true, so that if after hardening the dies are brought to their original position they will cut correctly. To do this the die, if of the flat variety shown in Fig. 6, should be drawn tight against the holder, as sometimes after the die is broken open for adjustment it warps out of position, and also the four lands should all be made to bear equally on the screw.

If in adjusting a die in a holder a screw is put in the die and the screws in holder over each land of the die are adjusted so the screw does not wabble more in one direction than in another, all lands will cut equally, the die will lead inside of the limit given above and good work will be insured.

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The Centigrade Thermometer.

William Drysdale, writing to the New York "Times" from Marseilles, France, says: "The Centigrade thermometer, the only one in use here, is a great trial to strangers who are accustomed to the Fahrenheit, and the trial becomes greater when we find how very much better the Centigrade is than our own, how much more sensibly arranged. With the freezing point for zero and the 100 point for boiling water, it leaves nothing to be desired but familiarity with it."

It seems strange and unaccountable that the Centrigrade scale is not universally adopted. It satisfies at once both science and common sense. Its substitution for our present absurd and inconvenient Fahrenheit would interfere with no line of business, would enable the scientific man and the man of the street and the shop to interchange at least one line of data without translation, and might lead the way to further reforms.

Screw Cutting Device for Any Pitch.

Referring to the device, illustrated and described on page 778 last year, for cutting any required fractional or other difficult pitch of screw, which device was seen in the shops of Bariquand et Marre in Paris, we are informed by Mr. John A. McGregor, superintendent of the Morse Twist Drill & Machine Company, that upon seeing the illustration it was at once apparent to him that the device was applicable to a problem which they then had in hand. They tried it with complete success.

The problem in this case was to produce a tap 1¾ inches diameter and with its threaded portion 6 inches long, 8 threads per inch, so that after hardening, the pitch should be correct; that is to say, much nearer to exactness than the usual tap of this size is, or, is expected to be.

Judging from experience of their own and others, Mr. McGregor concluded that such a tap might be expected to shrink in hardening very nearly .020 inch per foot of length, and, therefore, what this device had to accomplish was to increase the normal pitch of the screw by that amount.

Instead of using bevel gears of equal size, they used them in the proportion of 2 to 1, so as to reduce the necessary movement of the lever and the error pointed out by "M. E." On this basis they computed the hight of the template to give the required movement of the slide of the compound rest. The tap was then cut, finished and hardened.

To test the accuracy of the tap thus produced, the following method was adopted: In the shop is a lathe having a precision screw, which screw is known to be very accurate. In this lathe an arbor was placed, like that shown in Fig. 1, which is much like any other arbor, except that a cut is milled into it as shown, and four screws are tapped into one side of the cut. These screws serve to secure in place a strip of steel 1-16 inch thick, ⅞ inch wide and 6 inches long, its edge projecting above the surface of the arbor slightly more than the depth of the thread to be cut. With the lathe properly geared to cut exactly 8 threads per inch the projecting edge of this strip was notched as shown at Fig. 2, and this strip, when applied to the threads of the tap, served to show the error of the tap threads. Both tap and strip lie before us; we have repeatedly tried them together and the error, supposing there is an error, is so small as to be entirely negligible; in other words, the pitch of the tap, which was at first made too great and then shrunk in hardening, is now practically exactly the same as that of the test piece.

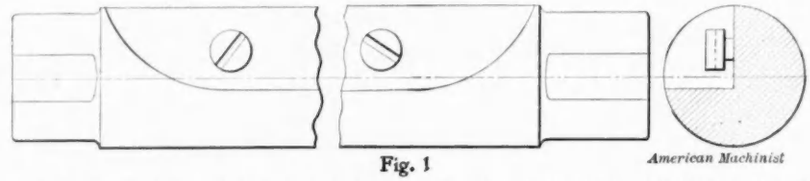

Fig. 1 American Machinist

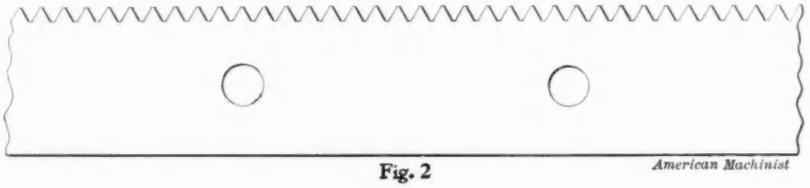

Fig. 2 American Machinist

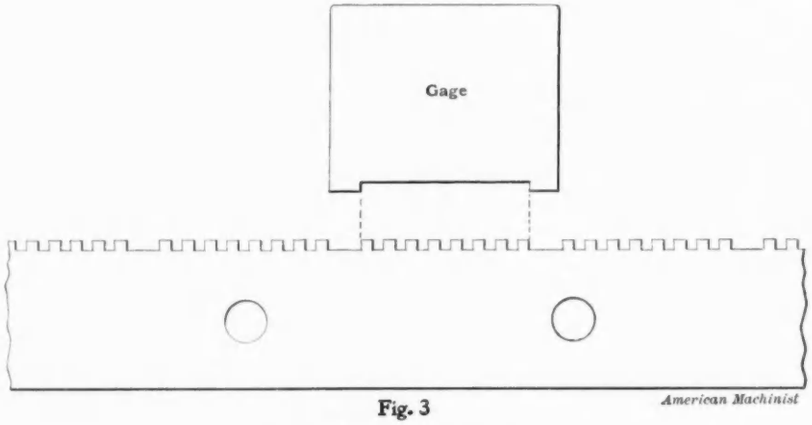

Fig. 3 American Machinist

TESTING-TOOLS FOR TAP.

In order to test for the possible effects of the error, due to the angular movement of the lever, Mr. McGregor made another test piece the same pitch as the tap had been cut, but otherwise the same as that shown in Fig. 2, except that a square instead of a U. S. standard thread was cut upon it. Then, at equal intervals, a tooth formed by this process was removed, as shown in Fig. 3, and a gage, as shown, was made which just fits nicely over 8 teeth. The gage fits precisely the same over each group of teeth, showing that the error due to angularity is negligible.

It is Mr. McGregor's opinion that this device constitutes a ready means of producing a thread which will be compensated for changes likely to take place in hardening, and its greatest value seems to be in the fact that slight changes of pitch may very readily be made to suit varying shrinkages, as experience with different steels, different sizes of taps or different methods of hardening them may prove to be desirable.

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British Engineering Trade.

Matheson & Grant, of London, have issued their half-yearly "Engineering Trades' Report," and in it say:

"Mechanical engineers in almost all departments continue busy, and those among the diverse industries who have been untrammelled by trades unions restrictions have lately been disbursing with advantage to all concerned more in wages than for many years past. Railway equipment, hydraulic and other machinery for engineers and steel-makers, electric lighting, electric transmission, and mining plant are among the branches of manufacture which have been most active. Whatever may be the returns to investors in the innumerable mining ventures launched during the past five years, such enterprises have undoubtedly proved advantageous to the engineering trades of this country, for that portion of the subscribed capital, really applied to development and working, has to a large extent reached their hands. Mining plant is divided into so many specialties, prospecting, sinking, getting, carrying, hauling, lifting, crushing and separating, that almost every branch of engineering has been benefited. Machine-tool makers have during the last year been actively engaged, not only in maintaining the engineering plant of the country, but in introducing many new inventions for improving and cheapening production. It appears likely that the artificial impediments to the free use of such machines which have held this country back in international competition are likely to be removed or relaxed by a better understanding with the trades unions.

A Handy Pipe Wrench.

The accompanying cut shows a recently patented pipe wrench which seems to be adapted to use on the larger sizes of pipe. As will be seen, it has the merit, often in such devices conspicuous by its absence, of grasping the pipe alike on all sides, and thus avoiding the likelihood of crushing it out of shape. The hand lever, which may be of any necessary length, swings upon its pin enough to allow the lower half of the clamp to drop entirely out of the way. When the other half is brought in contact with the pipe the jaws are closed and the necessary pinch is given by the short arm of the long lever. The thumb-screws give a handy means of adjustment. The pin connecting the lower jaw with the inner end of the long lever would seem generally to be unnecessary, although in some cases it might be convenient to keep the jaws closed. The patentee of this device is J. A. Hawthorn, Lancaster, Pa.

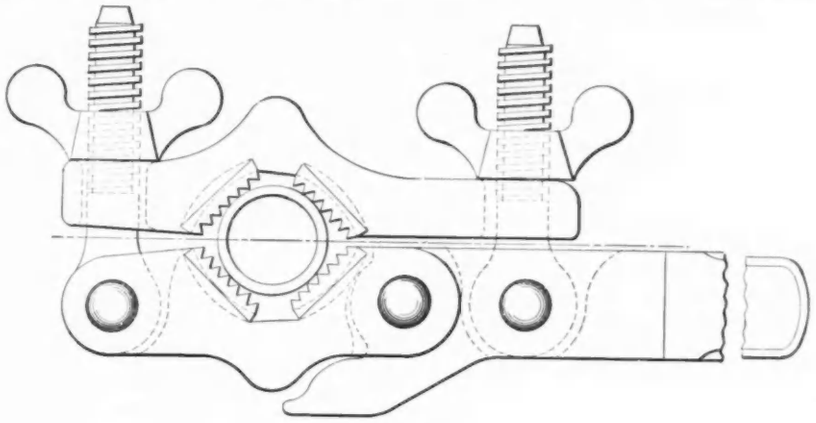

Fig. 1

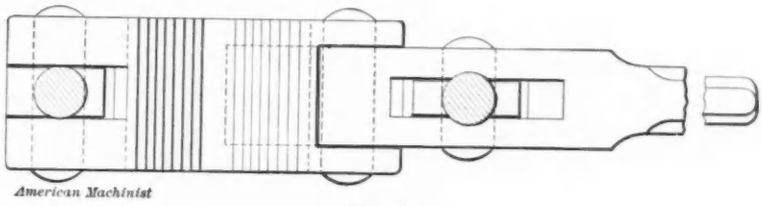

Fig. 2
WRENCH FOR LARGE PIPE.

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Some Bills Before Congress.

The following appropriations are asked for in the General Deficiency bill now before Congress:

$18,640 for the completion of new boilers and necessary repairs to the hull and machinery of the steamer "Fish Hawk."

$4,000 for the purchase of a steam launch for the use of the steamer "Albatross."

$600,000 is asked for by the Bureau of Construction and Repair for the purpose of the preservation and completition of vessels on the stocks and in ordinary; for the purchase of materials; for the purchase of machinery and tools; for carrying on the work of the experimental model tank, and for other incidental expenses.

$250,000 for the completion, repairing and preservation of machinery and boilers of naval vessels, including the cost of new boilers.

$2,000 for the purchase of material and new machinery for the Interior Department and the necessary repairs to the heating and lighting apparatus.

The bill asking for an appropriation for the construction of a gunboat on the Great Lakes, to take the place of the "Michigan," has been reported back to the Senate with the amendment that the limit of cost for same be placed at $260,000 instead of $300,000, as originally asked for.

Senator Morgan has introduced a bill asking for an appropriation of $400,000 to be placed at the disposal of the Secretary of the Navy to commence the construction of four coast-defense monitors of the "Miantonomoh," "Amphitrite," "Monadnock" and "Terror" class, fitted with the pneumatic system similar to that in use on the "Terror."

William C. Dodge, of the District, is asking for $10,000 for the use of a cartridge loading machine which was furnished by him to the United States, and for the use of his invention of the same, and for the use of his improved cartridges; also for the infringements of his patents.

There is a bill before the House looking to the establishment of an eight-hour system in all contracts for manual labor for the entire Union.

A. F. TENNILLE.

Washington, January 18.

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Letters from Practical Men.

Prevention of Halation in Shop Photographs.

Editor American Machinist:

Referring to a communication on "Shop Photography," page 816, last year:

"If the means for preventing halation be interesting to Mr. A. Randolph, as they no doubt are to every shop photographer, we strongly advise him to put on the back of the sensitive plate, before exposing, a thin, non-transparent black paper, well soaked in ordinary heavy mineral oil. This useful invention of our friend, Dr. G. B. Ermacora, of Padova, very effectively prevents halation, and the operation described is of course very readily done in a machine shop, where mineral oil is generally to be found—rather too much of it. Some care is necessary to clean the plate before developing.

We inclose two views of our own shops. BRIOSCHI, FINZI & CO.

Milan, Italy.

[The views referred are not photographs, but half-tone prints, and we therefore cannot judge by inspection of them as to how much halation there may have been in the plates. The prints show none. The device is certainly worth trying, and if any of our readers do try it, we hope they will inform us of the results.

We may add that the views refered to—an exterior and an interior—reveal handsome shop buildings of the latest and most approved form of construction.—ED.]

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Diameter and Pitch of Worms.

Editor American Machinist:

Referring to your articles on "Worm Gearing," which appeared in the issues of January 13 and 20, I notice that in Fig. 1 at the opening of the subject, the increase of pitch angle is supposed to be obtained by increasing the pitch—the diameter of the worm not being changed—but in the reference to the Hewes & Phillips worms, at the beginning of the second article, the increased pitch angle is obtained by reducing the diameter. It is obvious that in any case in practice the designer would have these two methods of varying the angle before him, and I would like to know if they are to be considered as equivalents, producing the same results, or if not, wherein they differ. C. F. WILLIAMS.

[From a mathematical standpoint, the two methods are identical; that is, at a given pitch line velocity a worm of a given angle should have the same efficiency, regardless of the diameter; but in a mechanical sense the methods are

not identical; since, for the same pitch-line velocity, the speed in revolutions per minute is greater for a small worm than for a large one. That is to say, a small worm will permit a greater velocity ratio than a large one, and inasmuch as worms are usually used because a large velocity ratio is required, it follows that small worms will usually be used. At the same time, in cases permitting a choice, the large worm has certain desirable qualities. Its larger mass gives it greater heat absorbing and dissipating properties, and its great circumference, by leaving so much of the thread surface disengaged, further facilitates the dissipation of heat. In addition to this, a large worm, by admitting a wheel of greater width of face, distributes the load over a greater surface.

While, therefore, below the cutting point large and small worms of the same angle should behave alike at the same pitch line velocity, the large one should at a given velocity carry a heavier load without cutting. In other words, in cases where the revolutions per minute are fixed, reducing the diameter produces a favorable change in the angle; but an unfavorable change in the amount of wearing surface and in heat dissipating powers. In the present state of knowledge, no exact balance between the two can be struck; but it would seem to be advisable, when the speed in revolutions is fixed, to reduce the diameter until a favorable angle is obtained; but no further.—F. A. H.]

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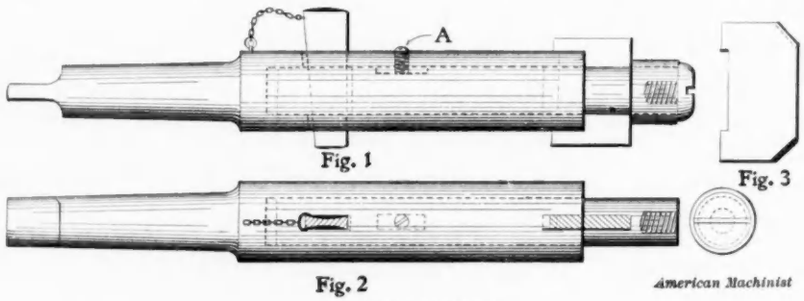
A Counterbore.

Editor American Machinist:

In the machines we build there are a number of hubs and bosses to square up and counterbore, and for this the tool shown by sketch takes the place of a number of the old style counterbores.



A COUNTERBORE.

Fig. 1 is a side view of the cutter with thimble attached; Fig. 2 an end view with thimble off; Fig. 3 shows a cutter for enlarging holes, designed to follow a twist drill.

I have a full set of the thimbles or bushings from ⅞ inch to 1½ inches by sixteenths, and have used this style of counterbore for drilling cast steel, drilling a 4-inch hole through 2-inch stock very readily.

In Fig. 1 will be seen a small headless set sc ew at *a*, which keeps the inside spindle from dropping out when changing cutters, but still allows the spindle free longitudinal motion. I make the bushings of cast steel and harden them to about a cold chisel blue; also can harden both ends of inside spindle and the round-headed screw at the end.

Portland, Me. W. A. Gowen.

[This counterbore is undoubtedly better than many others that are in use, but we think the key and chain are dangerous and liable to be somewhat in the way.

This objection can be overcome by making the central stem and the taper shank of one solid piece and fitting a sleeve over the stem; this sleeve being forced down upon and partly over the cutter by a nut threaded to the stem just below the taper shank. By this construction there are no projecting parts to catch the hands or the clothing of the machinist and it is less expensive to construct.—Ed.]

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Fly-Wheels in Electric Power Stations.

Editor American Machinist:

I have read in your issue of December 16 the article entitled "Too Much Fly-Wheel in Electric Power Stations," and I think Mr. Raworth is right when he says that an engine does not receive more shocks when used for electric traction service than for an electric lighting station, the parts of an engine having only to resist the pressure exerted on the piston, and depending thus on the pressure of the boiler. He is, however, mistaken when he thinks that a veavier fly-wheel is not necessary.

In fact, let us suppose an engine making 1,200 horse-power, and that in a given moment one takes suddenly away 1,000 horse-power. If the governor does not act the engine has already increased its number of revolutions by 6 per cent. in 1½ seconds with a fly-wheel making 20 meters (65½ feet per second) at the rim, and this latter weighing 40,000 kilos (88,000 pounds).

One will answer me that in 1½ seconds the governor will act; I trust it will, but it will not change the admission of steam so suddenly as to suppress 1,000 horse-power. It will take off perhaps 400 horse-power in the first second, and then in the second second 400 more, and in the third still another 400, which will allow the engine to increase its speed more than 5 per cent., and it will then slacken to a point below its normal speed, unless other perturbations should come and modify the action. Thus, if the fly-wheel was as light as for an electric lighting station, where the variations are not as great nor as sudden, the engine would get a disordered regulation; the governor could not be quick enough in its action, it needs time, and during this time it is the fly-wheel which must absorb or give out the power.

In my opinion the fly-wheel could be placed at the dynamo, because in making the former of iron one could give it a higher circumferential speed, and as the energy is proportional to the square of the revolutions of the fly-wheel, of which the rim is turning very quickly, the fly-wheel would have very little weight and would absorb less power, which is a loss. For instance: With 2,000 kilos (4,400 pounds) of fly-wheel rim at the dynamo and 40 meters (131 feet per second) circumferential speed one can supply the place of an 8,000 kilos (17,600 pounds) fly-wheel, of which the rim makes 20 meters (65½ feet) per second. This fly-wheel thus gives energy, on the dynamo, that is, where it is necessary, and prevents the excessive strain.

Moreover, the driving belt could not withstand so great strains in case of "short circuits." The alternate tensions and relaxations of the belt, and the sudden variations of power, are still a reason for variations of speed, not of the engine, but of the dynamo, because the elasticity of the belt in retaking its form increases the speed of the dynamo, and if one takes off a heavy load the contrary would be true when changing the dynamo. A. Bollinckx.

Brussels, Belgium.

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Chains and Chainless Wheels.

Editor American Machinist:

Under the heading "Chainless Bicycles," you give a timely warning to your readers to keep in mind the fact that a new departure or device, no matter how excellent or efficient it may be, does not take a single virtue from the old machine. The chain and sprocket used in bicycle construction are even more efficient to-day than they have ever been; they have proven a good power transmitting medium, and if properly encased from dirt will, no doubt, always rival the best forms of toothed gearing for bicycle propulsion. At any rate it is safe to assume that the chain will hold its own until one season, at least, has determined the superiority of other forms of gearing.

To one who has watched the various stages of improvement which have

marked the development of the chain and sprocket, the proportions of the toothed wheels, especially of the bevel type now on exhibition and for sale, seem very odd. If we go back a few years in bicycle construction and follow it down to date we shall find that the original small sprockets have gradually given way to sprockets of larger diameter. The reason is obvious. Under the best conditions of large gears or sprockets the strain upon bicycle gearing is much greater than is usually put on transmission members in other forms of machinery. This great strain is due to the foot pressure on the pedal multiplied by the ratio between crank length and radius of driving gear; hence the larger the sprocket or gear the less strain will be on chain or gear teeth.

All the various forms of chainless, of the bevel gear type, have driving wheels much smaller than were used on the original chain wheels, and the excessive strain due to small driving gear is aggravated by increased length of crank. The ratio of difference between length of crank and driving gear radius is so great that the foot pressure on pedal is several times multiplied, thus putting very severe duty on the few teeth in contact. Will they not show greater wear than a well made, hardened chain running on hardened sprockets? It will be interesting to watch the further development of the "chainless" ; one who does will probably see the driving gear of '98 give way to larger gearing in '99. It is possible, however, that these gears may be so thoroughly hardened and toughened that the wear may not be serious, if kept well oiled.

It is interesting to note that in the same issue with your article on "Chainless Bicycles" appears a notice that the Fox Machine Company, of Grand Rapids, Mich., has applied a bicycle chain to the movement of the knife carriage of their universal trimmer, the chain taking the place of rack and pinion, and with a very considerable improvement. We also know that the Morse Manufacturing Company, of Trumansburg, N. Y., are using their most excellent roller joint chain very generally, and with most excellent results, in driving machinery. Here are two cases where the chain has driven out the form of gearing now being introduced by bicycle manufacturers. Are we to have a double revolution with the survival of the fittest in the distance?

HARRIS TABOR.

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Percentages of Efficiency.

Editor American Machinist:

Mr. Sidney A. Reeve in his interesting and suggestive letter, in your issue of January 20, although he speaks in terms of kindly appreciation of my suggestions as to the percentage standard of steam engine efficiencies, seems, after all, to miss entirely the point to which I tried to call attention. I suppose I respect scientific methods and their results as profoundly as anyone. It is well to keep in constant view the possibilities that are revealed by the most remote and penetrating of investigations. When apparently the bottom of things is reached, as in the case of the ultimate units of heat or of power, they, of course, are the only fixed and absolute standards; but the trouble is that they are too far away for the use and appreciation of the everyday man. It is well for those who have compass and sextant and chronometer and charts and tables, and especially abundant leisure to work out their reckoning, to steer by the sun or the stars. The less venturous navigator prefers the bearings of the headlands that are in plain sight. When we use percentages, or when we read of performances as stated in percentages, we always think instantly of the 100 per cent. by which they are measured. The 100 per cent. mark is always thought of as something attainable under a sufficiently favorable combination of conditions. It is usually absurd and unpractical to use some standard which everybody knows to be absolutely impossible of attainment or even of approximation If instead of this some standard is adopted which is fairly in sight of and nearly in reach of the best practice, then the practical everyday man can appreciate the percentages of approach to such a standard, and the percentages then have in his mind something near their full force and value. It is not necessary to have absolute standards; it is necessary to have handy standards. We all know that the yard and the meter are not absolute measures, and yet most of the measuring of the world is done by them.

We can understand this thing better by a very practical application. Dr. Emry, in a table on the cost of steam power, published in the "American Machinist" April 1, 1897, treats of five typical classes of steam engines in general use, and assumes for them certain rates of water and coal consumption which his wide experience guarantees to be approximately correct. The figures which he gives are as follows: I invert the order in which they are mentioned in the table referred to, and I carry out the coal consumption:

	Pounds of Water per Hour.	Pounds of Coal per Hour.
(A) Triple compound condensing engine.....	14	1.64
(B) Compound condensing engine.....	18	2.12
(C) Auto. cut-off condensing engine.....	22	2.59
(D) Auto. cut-off non-condensing.....	28	3.39
(E) Ordinary non-condensing engine.....	42	5.6

Now the purely theoretical standard is so far away from this as to be out of sight. Science says, and proves beyond question, that .1823 pound of coal, or 2.219 pounds of steam per hour represent the equivalent of a horse-power. If we adopt these as standards and measure the performances represented in the above table by them, we get such interesting efficiency percentages as these; the percentages represent the actual power realized, as compared with the theoretical power represented by the water and the coal consumption, respectively:

	Percentage of Efficiency of Water Consumption.	Percentage of Efficiency of Coal Consumption.
(A)..	15.85	11.11
(B)...	12.33	8.60
(C)..	10.08	7.03
(D)..	7.92	5.38
(E)..	5.28	3.25

You may apply a very high pressure steam gage to a very low pressure boiler, and the gage may be very correct, but the engineer will still be troubled a great deal all the while to know "where he is at." These standards and these percentages are all right in the cabinet of the investigator, but the everyday man of the shop does not appreciate them, cannot use them to the best advantage, and should be provided with those better adapted to his ways.

If, instead of the scientific standards, we should assume, as before suggested, a consumption of 10 pounds of water or of 1 pound of coal per hour, we would have a standard not so absolutely and glaringly impossible. It would be a standard of performance that might be said to be within the sight and almost within the reach of the present generation of engineers, and the percentages realized would then be such as common people could appreciate. There would be some satisfaction and something to be learned in comparing the different efficiencies. By the standards which I am here suggesting (please don't say advocating) the percentages of efficiency of the performances in Dr. Emry's table would range as follows:

	Percentage of Efficiency of Water Consumption.	Percentage of Efficiency of Coal Consumption.
(A)..	71.43	60.97
(B)..	55.55	47.17
(C)..	45.45	38.61
(D)..	35.71	29.5
(E)..	23.81	17.85

This is simply providing a gage with wider scale and bigger figures. The results represented are precisely the same, but I think they are likely to be better appreciated. The differences in the performances of the different types

of engines are more accentuated. The gain that is to be realized by condensing and compounding is magnified enough for men to see it without glasses. The chance of some day realizing the 100 per cent. is not so remote as to be not worth working for. TECUMSEH SWIFT.

▲ ▲ ▲

A Constant Jig for the Drill.

Editor American Machinist:

Your issue of January 13 gave me several things to think about. Probably that jig for drilling flange couplings and such things without any laying out was what struck me most of all. I don't know whether it was worth while for anybody to get a patent on it, but the idea is all right, and it strikes me that it might be carried out considerably further. The builders of upright drills might take a hint from it, and provide a few simple arrangements on the drills that they build that would save lots of time that is now spent in laying out work, and the work would be more correct.

When the twist drill came into use it began to pick a quarrel with the center-punch the first thing. It came along with the intention and the ability to do better work than had been done before, and the center-punch, that had worked along on good terms with the old flat drill so long, was not good enough for it to associate with very long. The twist drill not only wants to do the right thing, but it wants to do it in the right place, which often happens to be very important. So far as the center-punch was concerned, the twist drill was much worse off than the old flat drill, because the point of it was not generally thin enough to hold in the center-punch mark. I have often had twist drills waltz off from center-punch marks in a most contemptuous way. In order to hold a twist drill any where near where we want it to go we have to accentuate the center-punch mark by drilling first with a drill that is not big enough to put on any independent airs. The big twist drill will follow the start of the little one as docile as could be wished.

There is apparently no chance of ever reinstating the center-punch. Its miserable existence is likely to be sustained for a long time on the odd jobs that it may pick up, but there is nothing like steady work for it any more. The twist drill has now taken to following the jig, and can hardly be trusted any more without it. The jig and the twist drill get along so well together that nothing could be imagined, probably, more likely to secure permanent peace in the family than to have a jig every time a hole is to be drilled. As I hinted before, the makers of the ordinary upright drills might do much to hasten the happy day.

The common, or, I might almost say, the standard upright drill—there are at least three by different makers shown in the advertising columns of the "American Machinist" of January 20—has a round table that you can turn around just as you want to and clamp it tight anywhere; this round table is mounted on a stout bracket that swings around the main column of the drill, and can be raised and lowered usually a foot or two. This bracket also can be clamped in any position. Now if I happened to find myself running one of those upright drills I would very soon begin to kick, first of all for a lot of circles on the face of the table. They could be a half an inch apart, or vary by an inch in diameter, and should cover the entire face of the table. When the table was faced up in the first place it would be a very simple matter, and would only take a few minutes to make these circles. With the table so marked, if I had any round pieces to drill I could locate them central and true on the table and clamp them there, and on general principles it pays usually to fasten your work there for drilling. I would get some kind of an index or pointer fixed on the table bracket and standing up by the side of the table. I would make a vertical mark on the side of the table, set the mark to coincide with the pointer and clamp the table. Then while the table was clamped in the bracket I would get a cutting point central in the spindle and swing the bracket around, carrying the table with it, and marking a circular mark all across the face of the table. The center of this mark would, of course, be the center of the drill column. This mark would be useful for locating work where there was a lot of holes to be drilled around a circle and it was necessary to have them symmetrically located with reference to some definite point of the circle; as, for instance, in drilling the end flanges of a big tee, where one hole must come central with the side flange, or two holes must come equidistant on each side of it.

A true vertical line should be scored on the turned part of the column where the table bracket fits, and with the center of the table central with the spindle a mark should be made on the top of the bracket coinciding with this vertical mark on the column. Then if the table was successively moved sidewise, say a quarter of an inch at a time, and a mark made on the top of the bracket, these marks or graduations would give a simple means of swinging the table out of the center any required distance without the necessity of measuring. The side or edge of the table should be divided into a convenient number of divisions, starting from the first mark already made coincident with the index or pointer previously provided. If two circles were provided with, say, 48 and 50 divisions, this would give the means of properly dividing lots of work that comes to the upright drill without laying out and with probably greater accuracy. We would then be able to keep the drill running right along without any dividers or scratch-awls or center-punches.

It would be necessary to have a guide for the end of the drill when starting, and especially if the surface was untrue; but there are so many ways of doing this that it is hardly worth while to suggest one. There might be a light arm fitted to the drill column to swing and clamp against a stop for the central position and swing out of the way when not in use. When in the central position the hole for the drill bushes might be bored by a tool in the drill spindle large enough for any bush that would be required. There should be means of raising and lowering this guide. The whole thing might be raised and lowered on the column, or, what would be better, there might be a rise and fall arrangement right at the drill center. This line of suggestion is, of course, not new; but it is still profitable to follow it. For spacing or laying out regular holes in straight lines, I remember that some ten years ago there was an article in the "American Machinist," with a cut showing parallel pieces clamped on a drill table to slide the work against and stops either way for the location endwise and other kinks in that line, and the name attached to the article was Fred J. Miller.

MORRIS FULTON.

Philadelphia.

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Pure Pig Iron.

Editor American Machinist:

I note in the last "Machinist" a statement, which I have seen in one or two other papers within a week, regarding the wonderful qualities of the pig iron produced at the Catasauqua furnace from ore separated by Edison's magnetic process, and in all the statements have been suggested the idea that it might lead to the discovery of a new metal! Now, I may be entirely wrong, but it does not seem to me to call for any new metal at all. What appears probable is that the excessive "brittleness," or ease of fracture, in ordinary pig, is due partly to excess of carbon and partly to silica and other ingredients, which are combined with the iron in the ordinary process in the blast furnace. By the Edison process the silica is removed in the crushed state by the magnetic separation, and the excess of carbon evaporated in the furnace, and the product is a much purer metallic iron, like Bessemer pig, if no carbon has been added in the shape of "spiegellism," or like ordinary puddled iron, after the carbon and slag have been worked out. I do not think it is necessary to look for any new metal, to produce the conditions which are said to

appear in this iron, and believe it to be simply pure iron.

SAM'L WEBBER.

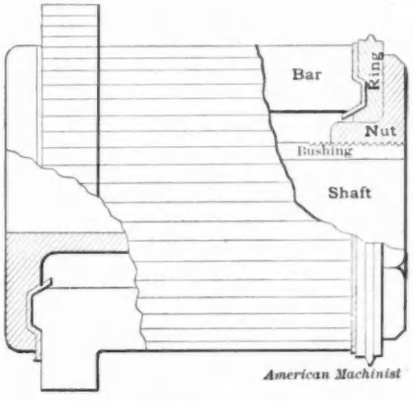
Charlestown, Mass.

▲ ▲ ▲

Commutator Construction.

Editor American Machinist:

I enclose herewith a sketch representing my new commutator, which possesses advantages over more common constructions. Most of those with which I am familiar are undoubtedly faulty on the nut end, the nut being usually abnormally thin relative to the duties performed. I consider them unsafe, and further, by their unnecessary thinness, oil is very liable to and does eventually work its way around the thread and get inside of the commutator, where it does damage by soaking into end insulation, thereby grounding the bars. On account of the high potential between the bars and adjacent ring, every effort should be used to maintain the insulation between



COMMUTATOR CONSTRUCTION.

them perfect. I therefore, in anticipation of the two above dangers, make my nut much longer inside, preserving the outside appearance, but greatly strengthening the whole construction. I desire also to call attention to the shape of the bar projection and corresponding ring groove, which make a very fine insulated joint without much extra preparation of the mica. It will also be noted that this shape allows for a substantial seat under the car, where heretofore nothing was provided in many cases, and in others wood or mica cores being substituted to prevent the cars from sinking. To those familiar with commutator work, the above points will undoubtedly receive consideration. Permanence of insulation is a subject of much serious consideration among electrical machinists, and all improvements designed to render such parts more efficient must be considered. My aim on this class of work is, above all, to prevent the initial short circuit. After having once established a connection the best insulation on earth is useless.

L. C. SHARP.

[We do not see that Mr. Sharp's construction is any more substantial than others in common use, but it is a common sense construction possessing obvious advantages.]

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Roots by Logarithms Having Negative Characteristics.

Editor American Machinist:

It seems to me that question 181, "American Machinist," of December 23, might be simplified by properly choosing the number to be added and subtracted. For instance, in the problem given add 10 or 100, multiplied by the required root, to the logarithm, and then subtract the 10 or 100 after dividing by the index of the root. Thus to solve

$$\sqrt[3.42]{.555}$$

$$\log .555 = \bar{1}.744293.$$
$$100 \times 3.42 = 342.$$

Adding these we have,

$$341.744293;$$

divided by 3.42, giving,

$$99.925231;$$

subtract 100, giving,

$$\bar{1}.925231;$$

which is log. of .84184.

Of course, the advantage of using these numbers lies in the fact that only one division is required and the addition and subtraction can be done mentally.

C. H. STODDARD.

Pittsburg, Pa.

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Broken Steam Pipes.

Editor American Machinist:

I have just finished reading a very interesting article on "Broken Steam Pipe at Sea," in your issue of January 6, by Charles A. Hague. It reminds me of the disaster on board the steamship "St. Paul," some two years ago, while at her dock in this port. I was then confident that the cause of that explosion was the rigid cast iron valves, bolted to the bulkheads, which had been cracked by the pitching and twisting strain they had been subjected to on previous voyages; the cooling after coming to port and reheating causing the casting to separate.

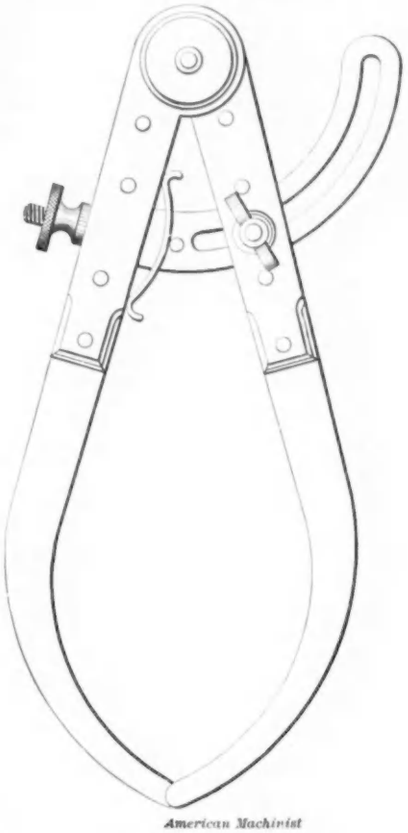
EUGENE LOTHRER,
Steamer "Acorn."

▲ ▲ ▲

New Caliper.

Editor American Machinist:

I have been experimenting to get the most simple, useful, and accurate calipering tools, and send you a sketch that will show what I have arrived at. I think every practical man will see the advantage of this construction. I once saw a man ruin a valuable forging by turning it down too small. He carefully set his calipers to a rose bit, and to make sure that they kept their set, he gave the thumb screw another twist. The calipers were of the mortice-and-wing type, with a thumb-screw that set down on the wing, and this screw happened to not have a true, level point, and when given the "twist," it acted on the wing as an excentric, or crank, and threw the points of the calipers ⅛ inch nearer each other. I make the upper part, forming the hinge, of three layers of ⅛-inch sheet steel,



A NEW CALIPER.

riveted together as shown, the central piece stopping off at the wing. The legs are inserted below the wing and riveted; the gap between the leg and the upper central piece forming the mortice for the wing. The mortice is the same in both sides of the calipers. The wing has a curved slot, as shown in the sketch, and a spring and thumb nut for fine adjustment. You will notice the spring is not riveted to the leg, as usual, but is curved at both ends, and rests against a pin in the wing. The spring is morticed and the wing passes through it. Instead of a screw I use a bolt and thumb nut to clamp the wing firmly between the sides of the mortice. With this construction it is impossible to throw the calipers out of set by tightening the screw, and if the thread strips it is an easy matter to substitute another bolt and thumb nut; when the calipers are as good as new.

This construction can be applied to dividers and tools of like character also.

R. W. J. STEWART.

The Air Cushion for Elevators.

Editor American Machinist:

Anyone wishing to gain an accurate idea of the motion of an elevator car in case of an accident has but to look at the formula,

$$T = \sqrt{\frac{2H}{G}}$$

For instance, should a car having a travel of 100 feet drop from the top of the shaft, the formula can afterward be applied in this way: T = Time, H = hight, G = Acceleratrix = 32.16, ∴

$$\text{Time} = \sqrt{\frac{2 \times 100}{32.16}} = 2.49 + \text{seconds},$$

and further data can sometimes be found in the newspapers.

This speed, 100 feet in 2½ seconds, will explain, too, why appliances by means of which the safety devices are thrown in from the car have been so slow in getting into use. There was no need of providing for overspeeding in the older styles of elevators, and in case of breakage, the designers placed no reliance on what a terrified elevator runner could do in less than three seconds. Some of the earlier designers did not wish to depend wholly on automatic devices, which were liable to be tampered with or become inoperative from other causes, and so the air cushion came into use as a safety device.

The first air cushions were made of strong planks fastened to the lowest floor by hinges on the top end. The lower end of each plank was slanted out into the hatch about a foot by a strong spring placed between the plank and a strong wall or other support. In this form the chamber was not airtight, both the air cushion and the planks, which acted as clamps, being depended on to stop the descent. Another device, patented many years ago, called for a cylinder, piston and rod on the bottom of the car, the piston to be driven into the cylinder if the car struck the bottom. The cylinder was to have openings so sized and located as to let out enough air to prevent the rebound.

I think the first successful air cushion was the Ellithorpe. This was a chamber having parallel sides, strongly built and well bound. The platform was faced with rubber, so as to fit the chamber snugly. Means were provided to let out enough air to prevent the rebound. It is said that the Ellithorpe air cushion was brought to such perfection that baskets of eggs could be placed on the car and not be broken when the car was dropped.

I would like to inform Mr. Tecumseh Swift that air cushions are still being built for elevator use. I worked for Morse, Williams & Co., Philadelphia, last year, and helped install quite a number of elevators. In two large buildings in which I worked the elevators were provided with air cushions. Morse, Williams & Co. put in an air cushion about 12 or 15 feet in depth. The chamber has a slight taper; there is half an inch space between the platform and walls at the top of chamber, and the platform will just fit about 3 feet from the bottom of shaft. A copy of the specifications for the elevators happened to be among the blue prints. I think the paragraph relating to the air cushion stated that each car should be dropped twice, once with full load, and once without any load. When channels are cut in an air cushion chamber for counterweights, hand ropes, etc., they are, of course, covered with a strong sheet of boiler iron.

Air cushions also form a safety device of quite another character. They are a help to the fire department, as they keep a blaze in the basement from spreading to the elevator shaft. Unless carefully designed, such a shaft is nothing but a very dangerous flue. As it is almost always necessary to take goods to the basement, air cushions have not come into use for freight elevators.

I am glad to see that the "American Machinist" has brought up the subject of elevator safety. I have no doubt that such a progressive paper can bring about a greater use of efficient safety devices for this method of transportation.

STEADY REST.

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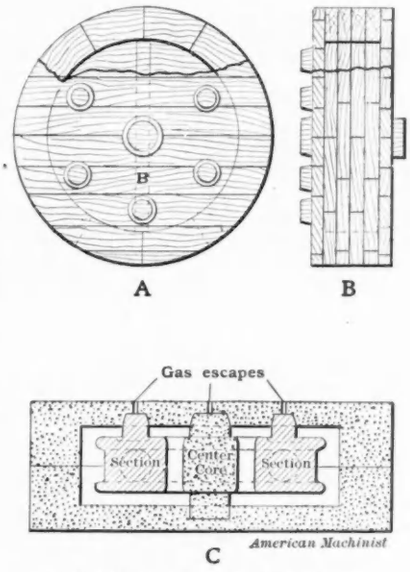
Another Piston Pattern.

Editor American Machinist:

Will a pattern constructed as described by Mr. Willard, December 16, 1897, retain its shape? Referring to his illustrations, Figs. 3 and 4, the headers *A* will shrink lengthwise, and in doing so will draw the narrow lags *C* to an elliptic form, and to such an extent as to greatly endanger the allowance for finish. The "cheap" of the method of "trueing" with a small plane compared to turning is about as 3 to 1, with best results in favor of the latter. Why does Mr. Willard prefer to make a three-part core (Fig. 7) of the two-part lighting core made in core box (Fig. 5 and 6) and the "small core" made in core box (Fig. 9), fastening them together and thus endangering, as it does, the work of the molder? As shown in his Fig. 10, probably "the core cannot rise and spoil the casting," but what assurance is there of its remaining in place, held only by the paste on the small surface of the round core? It looks very suspicious. This method for small pistons would hardly be considered, while for large ones it would be very unsafe.

A better method for making this pattern would be to construct the pattern in segments, to true the outer diameter by turning, and to add a few core prints (one for each segment of the lighting core), as shown at *A* and *B*. Then the core box should be made of such form as to produce a core segment in one piece, having a section as at *C*, thus avoiding the application of the paste in securing the two halves of the lighting and the "small core." It will also readily find its place, and be securely held in the mold. A pattern and core box so constructed makes easy and sure the work



PISTON PATTERN AND MOLD.

of the molder who may have many castings to produce from them. This pattern method may not be quite so quick and cheap, as the core box would require a little more time. The pattern (18 inch diameter) can be finished in three hours and turned in fifteen minutes. The saving in the foundry is easily seen.

WM. PILTON.

Hamilton, Ohio.

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Foreign News Notes.

The news has reached the United States from the Congo Free State that no restriction of any kind is placed upon foreigners intending to engage in any business enterprises in that State. The only restrictions that could be classed as such are the tariff regulations, by which all traffic in modern firearms is absolutely prohibited.

The duty on arms, ammunition and gunpowder is 10 per cent. ad valorem. All other goods, except those on the free list, pay a duty of 6 per cent. ad valorem. The free list includes locomotives, cars and any and all material for railroad construction.

The importation of arms into Persia is forbidden, but the neighbors happen to keep well supplied with them, for large numbers are smuggled into the country in bales of cotton. Arms are manufac-

tured in several Persian towns, but the product is of a very inferior quality. In Kurdistan all the natives are armed with Martini rifles, imported over the Turkish frontier. Revolvers and pistols sell at good prices in that country, and there would be a good opening for any firm who would get permission from the Persian Government to import them.

A Government cartridge factory has been established at Quebec, Canada. In 1895 the output was 96,600 Martini-Henry ball cartridges and 530,000 Lee-Metford blank cartridges. New machinery has recently been imported from England for the manufacture of the last-named cartridge; it is driven by a 20-horse-power electric motor.

There is a steadily increasing demand for corrugated sheet iron in Zanzibar. The price ranges from $1.55 to $1.75 per frazilla of 35 pounds. At the present time this trade is almost wholly supplied by English firms, but there is an abundant opportunity for any other manufacturers.

The importations of sheet iron into Japan have lately increased more than 50 per cent. A special demand is noted for use in the construction of ships, bridges and of steam boilers. Most of this demand is met by English, German, Belgian and French manufacturers. There is also an increasing demand for galvanized iron, to be used in the construction of factories.

There is reported to be a good market in India for paper-making and brewing machinery, glass-blowing apparatus, match-making machinery, machine tools, jacks and hoists, portable railways, pumps and shafting.

A. F. TENNILLE.

Washington, D. C.

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A Year's British Exports of Machinery.

Considering the enormous difficulties which, on account of the engineering strike at home and of foreign complications abroad, our engineering trades have had to face, it is not any wonder that the total value of the machinery and steam engine shipments should be below those of last year [1896], but the marvel rather is that they are so good. For instance, the total value of the steam engines of all kinds shipped to all markets in 1897, which is £3,040,073, is by no means far behind the £3,286,353 of 1896. Locomotives have scarcely altered, being £1,012,587, as compared with £1,077,823, and it is satisfactory to find that, although South American requirements have receded on the year, those of India have advanced from £186,009 to £233,521. Agricultural machinery shipments for 1897 have been £524,672, against £541,437 the previous year. South America, South Africa and India have been the chief defaulters, but Europe has progressed from £381,009 to £402,036, and Australia from £13,789 to £24,017. Other descriptions of machinery also are only a little behind last year, being of the value of £1,502,814, as compared with £1,667,093, and under this head we have done an increased business with the lesser European markets by the difference between £131,189 and £151,115; and with the group of miscellaneous markets which always brings up the rear at the foot of the returns, under the collective title of "other countries," by the difference between £280,742 and £297,463. With respect to general machinery we are still doing an annual trade of considerably over thirteen millions sterling, the 1897 total being £13,242,012, as compared with £13,727,897 in 1896. Agricultural machinery was sent abroad to almost exactly the same extent as a year ago, namely, to the value of £663,095, against £663,785; Europe improving from £461,107 to £474,208, and Australasia from £42,888 to £74,962; and although the mining machinery total to all markets was £874,627, against £1,048,485, yet Europe developed from £32,107 to £33,646, and India from £67,647 to £86,933. In our great textile machinery trade the aggregate value of the 1897 shipments was £5,702,878, contrasted with £6,745,720 for 1896. Japan is still an increasingly valuable customer. With other descriptions of machinery we are glad to see an advance in the total exports from £4,314,487 to £4,925,479.—The Engineer.

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Work of the Manuscript Factory.

We have previously referred to the product of the New England manuscript factory, and an esteemed correspondent sends in the latest example of it, which tells us how to make commutators. This article is published in an electrical paper, and it is true, as our correspondent points out, that not a single operation described and illustrated would be practicable in the actual making of a commutator, and many of the operations are absolutely impossible to be performed in the manner indicated.

If we had abundance of spare room we should be glad to publish this article with our friend's criticism of it as an example of how far astray it is possible for one to go when writing on a subject of which he knows absolutely nothing; but there would be no instruction in it and we do not feel that we can spare the room simply for the sake of the amusement to be derived from it.

One point of information is to be derived from such publications, however, and that is as to the management of the ordinary trade journal; the usual idea seeming to be that for the successful floating of such journals it is necessary only to secure an able advertising solicitor; editors are a secondary and entirely minor consideration.

A Nonagenarian Mechanic With a History.

There died in Philadelphia on January 17 John Quirk, ninety-two years old, a mechanic of the old school, with an unusually eventful history. He was born in the Isle of Man, of well-to-do parents. He was educated at a private school until he was sixteen years old, when his father's estates were sold to pay an indorsement debt, and the son bound himself to a country blacksmith. Then he went to Liverpool and engaged with a foundryman, staying with him until his eighteenth birthday, when he shipped on a man-of-war bound for Buenos Ayres, and when he got there he, with a companion, deserted and started a carriage shop within the walls of an old church. The factory was successful, making spoked wheels instead of the solid wooden wheels used in that country before. The partner was killed by a religious fanatic, and Quirk enlisted on a privateer and soon after was wrecked on the coast of Montevideo. He crossed that peninsula on foot, after many hardships, making a journey of several hundred miles on foot to Buenos Ayres again. Then he started on a pleasure trip along the Brazilian coast, finally fetching up at the Island of St. Bartholomew, in the West Indies, and started a blacksmith shop and married a widow with three children. Business was good until the British emancipated the slaves and killed the slave-ship business. Quirk later had a prosperous smith and foundry business at St. Thomas, and lived there nearly forty years. This ended his mechanical career. He went to Philadelphia and then settled on a Pennsylvania farm. After that he was in Iowa, and then in Maryland, finally making his home in Philadelphia. He seems to have been restless to the last. His last trip from his extensive farm lands in Maryland he made alone, 100 miles by boat and 100 miles by rail, reaching his home only five days before he died.

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American Draftsmen.

The first annual meeting of the Baltimore Chapter of American Draftsmen took place the evening of the 7th inst., and the following officers were elected for the ensuing year: James W. Lee, naval constructor, United States Revenue Cutter Service, president; W. T. Hoffnagle, Mergenthaler Linotype Company, vice-president; John H. Spousler, Basshor Company, secretary, to succeed Edward A. Osse, resigned; D. D. Thomas, Columbian Iron Works, treasurer.

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It is said that there is in the Russian language no term for duplex steam pump, and that the word "worthington," with a small "w," has been adopted there for that purpose.

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The Reproach of Ignorance.

A formula in quite common use assures us that a man is not to blame for what he does not know. That is the usual form in which it is stated. What it is meant to say is that a man is not to blame for not knowing what he does not know. That depends. Sometimes he is not to blame and sometimes he is. If the general statement is true, why is it that it is so unsafe to use the word ignorance? We first state in so many words that ignorance guarantees innocence and immunity from blame, and yet there is scarcely a word that so surely carries or implies a greater or less flavor of reproach.

It is really and essentially a non-committal word, and it ought not to be made a dangerous or a recalcitrant word for the users. We have to use the word quite frequently, when all that we intend to convey by it is the bare fact of a lack of knowledge at a given time or under stated conditions, and yet we are often conscious that in our use of the word it carries or suggests more than we mean, and someone is more or less offended.

Our columns have lately given account of some disastrous explosions which have occurred in connection with compressed air, explosions which could certainly have been avoided if there had been sufficient ready knowledge as to the conditions of danger. Here certainly was ignorance, or lack of knowledge, and just as certainly there was blamelessness, because the means of knowing had not been accessible, and therefore the knowledge had not been acquired; and yet if, without explanation or qualification, we say that the accidents are the results of ignorance, it savors somewhat of brutality. Under the circumstances, the suggestion of the need of some innocuous and non-committal word to use when we want to speak of unavoidable and blameless lack of knowledge is a natural one.

No such word has been provided in our language, or at least no such word has come into familiar use, and upon second thought it is well that we have none. The reproach of ignorance, if at times unjust, is still a sharp spur to the pursuit of knowledge. Ignorance is not a permissible defense in any case except with the accompanying proof that it is unavoidable, the burden of proof being always upon it. As knowledge is always diffusing itself more and more, the plea of ignorance, as allowable in any particular case, becomes gradually more untenable until it must be abandoned. The class of accidents in connection with the use of compressed air to which we have alluded above cannot long be excused on account of ignorance, and they must soon cease to occur because the necessary safeguards of knowledge are becoming so generally diffused. Ignorance is a thing very proper to be ashamed of, even if we can't help it, and to be dispelled as fast as possible by every available means.

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A Government Swindle.

If a man should propose to get up a city directory and put into it only the names of persons foolish enough to pay $5 for that purpose he would be regarded as more or less crazy, and if he sold such directories would stand a good chance of prosecution for obtaining money under false pretenses. Yet, strange as it may seem, the United States Government is at present placed in the position of backing up an enterprise which is no whit better and not much, if any, different in principle.

One J. P. Smith is "working" this scheme. He apparently runs the Bureau of American Republics, and he proposes (in letters and circulars franked through the United States mails) to get up a directory of business firms, the names in which shall be only those whose owners have satisfied Mr. Smith that they are reliable and worthy of this quasi-indorsement of the United States Government. He charges $5 for each insertion of a name, and the natural presumption is that when a man declines to pay the $5 and is therefore not mentioned in this "directory," he is not reliable and should be avoided. In order to test the genuineness of this matter and find out how much trouble was taken to ascertain the commercial standing of firms paying their $5, a person known to the editor of Peck's "Export Index" sent $5 and the journal referred to gives the result as follows:

"To test the veracity and reliability of this so-called Government publication, a party known to the writer sent to Mr. Joseph P. Smith, director of the Bureau of American Republics, a five-dollar note, accompanied by a request to insert a given name in his directory. The most amusing part of it was that the name selected was a fictitious name, one which does not exist, never did exist and never will exist as a trading company or business organization. We can produce Mr. Smith's receipt for the insertion of this name. We shall be pleased to allow Mr. Smith to identify his own handwriting."

It is evident that this would be a disreputable business if carried on by private enterprise; when carried on under the wing of the Government and with its mail matter carried free under the franking privilege, it is a disgraceful outrage.

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Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(4) A. A. E., Detroit, Mich., has a beam supported and loaded as shown in the sketch, and he asks: What are the bending moments at S and C and how are they calculated? A.—In cases of this kind determine the magnitude of the reactions of the support and consider them as applied forces acting upward. In the present case it is obvious that reactions S and S' are each equal to P and P' or 9000 pounds. To find the bending moment at any section, consider the forces which act downward as positive and those which act upward as negative, and take the algebraic sum of the moments of all forces on one side of the section. At S or S' the moment is that of P or P' only, or $18 \times 9000 = 162000$-inch pounds. At C the moment of P is $36 \times 9000 = 324000$ inch pounds and that of S is $18 \times 9000 = 162000$-inch pounds. The moment of P is positive and that of S negative, the algebraic sum being 162000-inch pounds—the resultant moment at C. Note that the same moment will be obtained for all points between S and S'. Thus take S'' where the moment of P is $27 \times 9000 = 243000$-inch pounds, while the moment of S is $9 \times 9000 = 81000$-inch pounds, the resultant being as before 162000. We have disregarded the inclined action of the bale, as we infer that your perplexity does not relate to that.

(5) G. H. T., Johannesburg, South Africa, asks: What is the proper rule

used in the States to ascertain the horse-power of a boiler? A.—The rule generally used is known as "The Centennial Rule," and requires that the boiler shall have a capacity to evaporate 30 pounds of water per hour into dry steam from feed water at 100 degrees Fahrenheit, and under a pressure of 70 pounds per square inch for each horse-power. To get such an evaporation (which equals 34.5 pounds from and at 212 degrees Fahrenheit) under ordinary working conditions for boilers working on land they should have 11.5 square feet of heating surface and 1-3 square foot of grate surface per horse-power.

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The Strike-Lockout Settlement.

As was foreshadowed last week, the great engineering strike and "sympathetic" lockout in Great Britain has been brought to an end by the capitulation of the men and their acceptance of the employers' terms. It is at this writing too early to predict just what the effects, immediate and remote, will be; but one thing that seems certain is that the new conditions which will now obtain will be more favorable for the introduction of American machine-tools. This, however, may possibly be accompanied by less favorable conditions for the importation into Great Britain of other kinds of machinery and for competition with British builders in neutral markets.

We believe, however, that no material additional difficulty in doing business abroad will manifest itself for several years at least, and in the meantime our ability to compete in foreign markets will probably also increase.

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The Third Annual Convention of the National Association of Manufacturers.

The above-named convention was held in this city from January 25 to 27, the sessions being held in the main hall of the Masonic Temple. After the opening formalities in the way of speeches and the announcement of standing committees, the annual report of President Search was read. This report devoted considerable attention to the now familiar story of the great increase of exports of manufactured goods from this country, the figures showing a gross increase of 21 per cent. over the previous year. The most remarkable increase shown is in bicycles, of which the exports for 1897 were valued at $7,000,000, as against $1,898,000 for 1896. In pig iron the figures are $471,800 for 1896, against $2,331,000 for 1897; while steel in ingots, bars and rods shows $125,000, against $1,121,000, and in rails $540,000, against $2,482,000 for 1896 and 1897 respectively. In this connection Mr. Search gave a diagrammatic history of our export business since 1848, which shows that since 1887 the gross value of manufactured exports has exactly doubled, while the percentage of manufactured to gross exports has in the same time increased from 19 to 26 per cent. Accompanying this was a second diagram showing our great loss in the carrying trade, our exports and imports being carried in an ever-increasing amount and proportion by foreign shipping. Following this came some figures to show the great advantages which would accrue from the construction of the Nicaragua Canal; a presentation of the need of a Governmental Department of Commerce and Industries; and a presentation of the advantages and prospects for reciprocity arrangements with foreign nations. Following this came a presentation of the status of the sample warehouse in Caracas, Venezuela, from which it appears that a suitable building has been secured, to which some large shipments of goods have been made. The date of formal opening has not yet been set. In addition to its strictly commercial uses, this warehouse is to be made a school for the training of young men in the Spanish language and the commercial needs and customs of Spanish service. A special circular, giving interior and exterior views and plans of this warehouse, together with other particulars, has also been put out by the association. The establishment of similar warehouses is now under contemplation at Buenos Ayres, Argentine Republic; Kobe, Japan and Hamburg, Germany. Other subjects discussed in the report are Technical Education, Reform of the Consular Service, International Banking, National Bankrupcy Laws, State Taxation of Foreign Corporations, Untaxed Alcohol in the Arts, Patents and Patent Laws, the Metric System, and the Paris Exhibition of 1900.

In the afternoon the reports of various committees were read. The procedure of the association in these matters is to have subjects investigated and presented with recommendations by special committees, and after the presentation and discussion by the membership, the matter is referred to the Committee on Resolutions, who embody the sentiments of the association in a series of resolutions, which, at a later session are submitted to the membership, discussed again if necessary, and finally adopted, rejected or amended, as the case may be.

The subjects thus presented were: Transportation, Patents and Patent Laws, the Metric System, and the Governmental Department of Commerce and Industries.

The report on transportation concerned itself with the Interstate Commerce Law, discriminations by railroads, and uniform freight classification; but on this subject the Committee on Resolutions recommended that no action be taken; which was sustained.

The report on Patents and Patent Laws discussed the subjects of Annuities on Patents, Separate Courts for Patent Cases, Patent Office Procedure, International Patent Agreement, and false branding of foreign made goods. In the discussion of this report former Commissioner of Patents Seymour made some striking remarks, showing that most of the complaints of inefficiency in the Patent Office were due to lack of facilities—lack of room, in the first place, and lack of help in the second. He stated that the cost of the office building was no more than that of a single first-class battle-ship, and that its operation required no more men or money than such a ship. Moreover, the Patent Office is a direct source of revenue which exceeds its cost. In this matter the Committee on Resolutions reported later resolutions, which were adopted, asking the attention of Congress to the false branding of foreign-made goods, and promising co-operation with other commercial organizations in this matter, and also indorsing a bill now before Congress for increasing the accommodations of the Patent Office.

Relating to the report of the Committee on Commerce and Industries, the committee reported a resolution, which was adopted, indorsing the bill now before Congress for incorporating an International American Bank, and one authorizing the President to appoint a committee of five for the purpose of furthering and assisting the coming second Pan-American Congress.

The Committee on Language, Weights and Measures made a report favoring the compulsory adoption of the metric system, which, however, was practically turned down by the Committee on Resolutions, which reported that, while favorable to action that would promote the use of that system, it could not agree to its being made compulsory, and it recommended that the question be referred back to the Committee on Language, Weights and Measures, and that that committee be increased in number to fifteen.

Under the head of Miscellaneous Business the question of the keeping by the secretary of a register of positions open in connection with foreign business was discussed, and was finally referred to the Executive Committee with power to act. The evening of Wednesday was devoted chiefly to the presentation of addresses on various subjects. Mr. Fletcher W. Hewes presented some elaborate trade charts, showing how small a proportion of the imports of South American countries was supplied by this country, as well as a history of our import and export trade with England, Germany, Brazil and other countries, and a history of the rise and fall of American shipping. Mr. Richard Young, who recently made a trip around the world, made a striking address, showing the incompetence, inefficiency and general demoralization of

our consular service. Mr. Young's address was the old, old story, which, however, was all the more impressive because of his wide acquaintance with the facts, and which cannot be told too often until a remedy is found.

A Committee on Reorganization of the Consular Service was appointed, consisting of the following members: Chas. Davis, Ohio; Richard Young, New York; J. M. Studebaker, Indiana; A. B. Farquahr, Pennsylvania; T. Stewart Wood, Pennsylvania.

Mr. E. H. Sanborn described the work of the bureaus of publicity and information. Of these the former is devoted to general work in making the association and its objects known, while the latter is devoted to the furnishing of specific information in answer to questions by foreign and home inquirers. This bureau has grown without effort, until a force of eleven persons is required to conduct it. It probably gives the members more direct returns for their expenses of membership than any other feature of the association.

The session closed with a paper on the Paris Exhibition of 1900, in which the statement was made that 200,000 square feet of space had been secured for American exhibits. The system of classification was also described, which is to place like exhibits alongside one another instead of grouping the exhibits of each country by themselves, as at previous exhibitions. The Committee on Resolutions reported a resolution, which was adopted, stating that it was of the utmost importance that American manufacturers be adequately represented, and urging Congress to make a liberal appropriation for that purpose.

The chief business of the concluding session of Thursday morning was the election of officers, President Search and Secretary Wilson being re-elected, while Mr. C. A. Schieren was made Treasurer. There was a prospect at the beginning of a lively fight over the secretaryship, but in the end Mr. Wilson was elected unanimously. The place of the next meeting was fixed at Cincinnati.

The banquet in the evening was especially notable by the presence of President McKinley; but, on the other hand, the presence of the President is an illustration to all of the importance to which the association has grown. The banquet was attended by a representative of the "American Machinist," who previously supposed he had seen such things before, but who knows better now. It was the greatest event of the kind ever seen in New York city. The principal speech of the evening was, of course, that of the President, which was especially significant by reason of his unmistakably pronounced stand in favor of the gold standard of value. The President's remarks aroused the audience to the wildest pitch of enthusiasm. The writer has never before seen an equal demonstration of approval of a speech of any kind. The banquet was held in the large ballroom of the Waldorf-Astoria, with an overflow in the Astor Gallery of the same hotel. Places were assigned to 984 people.

The significance of the President's presence was increased by the fact that at the organization of the association in Cincinnati three years ago he was present, as the Governor of Ohio, at the corresponding dinner at which twenty-five people sat down. The association of to-day, with its 1,200 members, is a monument to Cincinnati enterprise, although, successful as it has become, it is at present considered by its leading men as only at the threshold of its greatness. The plans now made will not be fulfilled until every important commercial city of the globe has its accredited agent of the association. All that is necessary to carry out these plans is the revenue due to a larger membership, and with the rapid growth of the past two years and the impetus now acquired, this enlarged membership would seem to be fairly assured.

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Obituary.

Jacob G. Neafie, the founder and head of the Neafie & Levy Ship & Engine Building Company, of Philadelphia, died at his home in that city on January 16, aged eighty-two years. Mr. Neafie was born in Monmouth County, N. J., and passed his earlier years and received a common school education in New York city. At the age of sixteen he started to learn the trades of blacksmith and machinist. He soon developed a talent for pattern-making and designing and was foreman of the shop of Thomas G. Halloway, in Philadelphia, a year or two before attaining his majority. He started a shop of his own in 1838. Six years later the business had grown so that the firm of Reany, Neafie & Co. was formed. The firm became Neafie & Levy in 1860. The yard built engines for several Government vessels which were in service during the Mexican war. During the war for the Union engines were built at the works for about 120 Government vessels. The shop numbers of the vessels built in the yard have reached 900. Mr. Neafie was the inventor of a propeller wheel, and the foundry turned out large numbers of wheels for other concerns. A widow and one daughter survive him.

John Hill died in Columbus, Ga., January 18. He was born in New Salem, Ill., in 1839. His father, a merchant and manufacturer, died in 1857, and the son, upon leaving college, took charge of the business. Later Mr. Hill was manager of the Howe Manufacturing Company, of Jacksonville, Ill. He moved to Columbus in 1872, becoming superintendent of the woolen department of the Eagle and Phœnix Mills, and afterward mechanical engineer for the same company. He built a number of mills for different companies, was the inventor of an automatic sprinkler and various other mechanical and electrical devices.

Oliver Blackburn Shallenberger, an eminent electrician and engineer of the Westinghouse Company, recently died suddenly at Colorado Springs, Col. Mr. Shallenberger was educated at the Annapolis Naval Academy, resigning from the navy in 1883. He joined the Westinghouse Company, and was the inventor of many devices which won fame and wealth for that organization and also for himself. He was active in furnishing the data and plans for the machinery of the Niagara Power Company, and also inaugurated the electric plant at Colorado Springs, to furnish power to the Cripple Creek mining field.

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Founders' Association.

The National Founders' Association was formed in this city during the recent meeting of the Manufacturers' Association. Its officers are: W. H. Pfaehler, Philadelphia, president; C. L. Newcombe, Holyoke, Mass., vice-president; W. H. Wells, Lockport, N. Y., treasurer, and John A. Penton, of Detroit, secretary.

Its main objects are to deal with labor difficulties, and more especially to meet organization with organization, and deal with such difficulties as may arise in accordance with business principles and common sense. As we understand it, the new association will freely concede the right of the men to maintain organizations and that it is expected that the representatives of the two sides of any dispute that may arise will be able to settle it authoritatively and to the satisfaction of all concerned.

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Personal.

Passed Assistant Engineer E. H. Scribner, U. S. N., is appointed inspector of boiler tubes at Philadelphia.

Chief Engineer J. D. Ford, U. S. N., has been detached from the "Brooklyn" and ordered to the "Baltimore."

Mr. Oscar Hammar, formerly with the Brown & Sharpe Manufacturing Company, has become manager of the Hammar Manufacturing Company, at Leechburg, Pa.

Mr. W. S. Huyette has resigned his position as consulting engineer to Gilbert Wilkes, of Detroit, and about February 1 will take a position as contracting engineer with Wilkes Brothers, of Saginaw, Mich. He will be located at Milwaukee, and will have charge of the

business in Wisconsin and Minnesota for the sale of boilers and feed-water heaters.

Passed Assistant Engineer H. G. Leopold, U. S. N., is detached from the Mare Island Navy Yard and ordered to the "Monterey."

Kindly oblige us by sending in personal items regarding changes of foremen, superintendents and others prominently connected with the machine business.

Chief Engineer A. Kirby, U. S. N., was ordered to the Washington Navy Yard, February 1, for examination by the Board of Medical Survey, and to wait orders.

A. A. Parmenter, who for the past year has been general foreman of the machine shops of Ames Iron Works, has tendered his resignation, to take effect February 15.

Mr. C. E. Peck, who for some time has been in charge of the milling department of the factory of the T. & B. Tool Company, Danbury, Conn., has been placed in charge of the tool department as well.

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Inquiries for Machinery.

Those who make, or may know of the makers of such machinery as is called for below, will oblige us by sending name and address, mentioning the number of the inquiry. We cannot forward catalogs. We have inquiries as follows:

30—For a machine for cutting one side of a long strip of iron so it will have teeth like those of a horseshoer's rasp.

31—For makers of machinery used in manufacture of brushes.

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Technical Books.

"THE ARITHMETIC OF THE STEAM ENGINE." By E. Sherman Gould; 77 5¼x8 inch pages, with six illustrations. D. Van Nostrand Company. Price, $1.

This book is the product of the author's own needs. Mr. Gould is a civil engineer who has made a specialty of water works construction, in which work he had occasion to make various calculations regarding the duty, capacity and general performance of steam engines of various types. The information necessary for such work was only found after laborious search through numerous treatises, and when found was noted and finally collected together to form this volume. The book does not enter upon the calculations for proportioning parts and details, its field being confined to general principles. In this field it discusses heat, the properties of steam, combustion, power, indicator diagrams, steam distribution, the compound engine and similar topics. The contributions which we have published from Mr. Gould's pen will have shown our readers what to expect from him in the way of condensation and clearness. His book is strictly scientific, though couched in plain language, there being no mathematical work beyond a few simple equations, which are clearer than the same information could possibly be made in the form of arithmetical rules. The book is excellently printed and bound, and concludes with tables of the properties of steam and of hyperbolic logarithms.

WHITTAKER'S MECHANICAL ENGINEERS' POCKET-BOOK. By Philip R. Bjorling. 377 3½x6-inch pages, with 28 illustrations and 130 tables. The Macmillan Company, New York. Price $1.75.

This is a book in which there is not a superfluous word, and in consequence of its extreme compactness it is made to cover an enormous field without exceeding the limits of an ordinary pocket-book in size. It is doubtful, however, if in it condensation is not carried too far. Formulas are presented without comment or discussion, no effort being made to point out the sources of their constants or the limits of their applicability, as would be expected from the author; an unusual amount of space is devoted to pumps, and, in fact, to hydraulic machinery of all kinds. In this field the book gives, probably, more condensed information than is elsewhere available. Mining machinery of all kinds also receives more attention than usual, while the profusion of mathematical and other tables, exceeds anything we have elsewhere seen.

It is often said that one must go away from home to learn the news, and we here learn for the first time that there is such a thing as the New York gallon of 221.819 cubic inches, or exactly 8 pounds of water.

INTRODUCTORY COURSE IN MECHANICAL DRAWING. By J. E. Tracy, instructor in the Sheffield Scientific School of Yale University. 100 7½x10½ inch pages, with 163 illustrations in the text and eight full-page plates. Harper & Brothers.

This book does not cover the subject of machine drawing, but is intended to be introductory to either machine or architectural work. It is hence, practically, a treatise on projection and perspective. As such it is excellent, the work on projection being put in some respects more clearly than we have elsewhere seen it. This is accomplished through the liberal use of half-tone pictures of models of the work to be drawn, in connection with surrounding glass boxes representing the planes of projection on which the projections of the models seen within are drawn. The drawing of sections and intersections is thus made plainer than is otherwise possible without having the actual models before one. The treatment of perspective also, while brief, is good.

The actual instruction of this kind is preceded by what we must consider as excessively and unnecessarily minute instructions regarding the selection, use and care of instruments, while some work is introduced for that entirely superfluous object "practice in the use of the instruments." We are told, for example, that "all pieces should be wiped with cloth or chamois after using"—something which no one does after his school days. The writer's instruments are over twenty years old, and it is at least nineteen since they have been subjected to this process—and they still make lines that are straight and circles that are round. This neglect is perhaps reprehensible, but it is certainly well nigh universal in drawing offices.

We have received No. 9 of Prof. J. G. A. Meyer's "Easy Lessons in Mechanical Drawing and Machine Design." Each succeeding number brings added assurance that students are here furnished the real thing. The plates are absolute reproductions of the fine and excellent handiwork of the author, and the text gives minute instructions, both in the technicalities of drawing and in the computations involved in the designing of machinery.

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England and Belgium, "the Great," Etc.

Every natural advantage possessed by the great iron and machinery producing countries of the world—such as England and Belgium—is said to be present in the colony of New South Wales. Not only are iron and coal deposited in abundance and in positions easily accessible and readily worked, but the local iron ore is exceedingly rich.—The Engineer, London.

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We have received from the Brown & Sharpe Mfg. Company, Providence, R. I., a copy of their recently revised "Terms of Apprenticeship," by which we note that they receive apprentices upon practically the same terms as heretofore, with the exception that they now require the parents or guardians of the new apprentice to pay the sum of $50 at the expiration of a term of trial, consisting of 480 hours of service. Upon the completion of the term of apprenticeship, which consists of four years of 295 working days of ten hours each, the apprentice receives $150 in addition to the wages paid during the term of apprenticeship, which wages are, for the first year, 6; for the second, 8; for the third, 10, and for the fourth year 14 cents per hour.

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A turbine engine for experimental purposes in connection with small torpedo-boat service is to be constructed at the Brooklyn Navy Yard.

Commercial Review.

NEW YORK, Saturday Evening, Jan. 29, 1898.

In the electrical machinery line, the demand continues most excellent. Several companies seem to be busier even than they were at the end of the year, which is saying considerable. Two concerns find it a little duller in new orders, but it so happens that one of these is still running its shop twenty-two hours a day and the other was on extra time until a week ago, and expects to return to it about February 15. If that is what dullness means we should like to see a little more of it. One company which was on night time before the holidays is now endeavoring to squeeze even more work out of its plant than in December. "In old times," remarks one of its representatives, "when a man came to us to buy a 1 horse-power motor we could hand it down from the shelf. Now we have to make him wait three weeks for it, and if he is not in too great a hurry, five weeks. We are crowding hard upon our supply people—'We want that copper right away,' 'When will you get that wire ready for us?'" One reason why factories are now so busy is said to be that they allowed their stocks to run down during the times of depression.

LIGHTING, POWER AND RAILWAY MACHINERY.

Coming now to speak of what is being done, has lately been done, or is contemplated in these three lines specifically, we may premise that they are all pretty good. It is, however, a between-seasons time in lighting, and consequently some companies who handle both motors and lighting generators notice that the former are more in demand. In railway work some large orders have come in, both at home and from abroad. The news that the General Electric Company is to build thirty-two electric locomotives for the Central London Underground Railway was noted in our columns last week. This order was included in the original contracts between the railway and the British Thompson-Houston Company for the equipment for the road, but it has been supposed previously that these locomotives would be built in England. The latter company has now turned the con-

Continued on page 41.

Business Specials.

Gear wheels, gear cutting. Grant; see page 20.

Power hammers, Jenkins & Lingle, Bellefonte, Pa.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Conn.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y

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Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

Experienced mech. draftsman, Box 54 AM. MACH.

First-class draftsman and designer, tech. graduate, with six years' best exp. Box 37, AM. MACHINIST.

Mech. draftsman and mchst.; exper. steam, marine pnmp, gen. mach.; desires position. Box 18. AM. MACH.

A good mech. draftsman wishes position. Address G. W., care of A. Warth, No. 40 Second Street, N Y. city.

Thoro'ly prac. d'ftsman and designer; 3 years' shop exp., 5 years d'fting, desires a change, Box 57, AM. MA.

A graduate from a technical institute in Germany, also experience as a draftsman, desires a position. E. S. B., Room 46, 156 Broadway, New York.

Young man desires change; wants situation as machinist and pattern maker; can also do drafting; best of reference. Box 58, AMERICAN MACHINIST.

First-class draftsman and mechl. engineer; 20 years' varied exp.; designer of high-grade eng., etc.; open for eng. Address Box 10, Painted Post, N. Y.

Pattern maker, first-class and practical, wants a position as foreman; experienced on engine and general machine work. Box 49, AMERICAN MACHINIST.

Wanted—Situation as foreman, supt. or master mechanic, by a first-class mechanic of experience and ability; best of reference. Box 56, AM. MACHINIST.

Situation wanted by draftsman and designer; 9 yrs'. experience; automatic machinery, tools, engines, boil. ers, and use of steam eng. indicator. Box 44, AM. MACH-

A practical, up-to-date foundryman desires position as foreman, familiar with heavy and light mach'y engine and boiler castings, chilled and sand rolls; good habits, good references. Box 50, AM. MACHINIST.

Situation wanted as foreman, master mechanic or any capacity requiring the services of a first-class mechanic; exp. in marine and stationary work; vicinity of New York preferred. Box 32, AM. MACHINIST.

Experienced man on design construction, erection, and repairs of engs., boilers, mechanical stokers, small loco. and coal mine mach., wants to change; cannot consider sal. below $100 per. mon.; age 35. Box 52, AM. MACH.

Situation wrnted as machine shop foreman or toolmaker by practical mechanic; 10 years' experience on new inventions and interchangeable system; very successful in past; best of references from last and previous employers; habits strictly sober. Box 61, AM. MA.

Engineer, 32, thorough tech. education; member A. S. M. E.; splendid experience as constructing eng. and manager, desires change; knows modern methods of mach. designing and shop practice; immense exp. on construction Corliss and other engs., air compressors, ice mach. and the most improved gas eng. practice; competent to assume charge of works of any magnitude; pos. as gen. supt. or chief eng. wanted; highest testimols. from all past employers. Box 20, AM. MACH.

Help Wanted.

Wanted—German speaking mechanic suitable for salesman in machinery line. Foreign, AM. MACH.

Wanted—A good draftsman on high speed eng's; one familiar with foundry work preferred. Box 51, AM. MA.

Wanted machine shop foreman accustomed to high speed engine work; state fully experience. Box 60, AMERICAN MACHINIST.

Wanted—A young man as foreman of die room drop forging; an unusual opportunity with an old concern for a strictly first-class man. Box 55, AM. MACHINIST.

Wanted—An A No. 1 draftsman with experience in locomotive work as well as general machinery; a good salary to competent party; location in Ohio. Address Locomotive Draftsman, care AM. MACH.

Mechanic capable of designing small tools, jigs and special machines for large plant, and competent to take full charge of department doing this class of work. state experience and references. Address Beans, care of the AMERICAN MACHINIST.

Wanted—First-class working foreman for blacksmith, hardening and tempering department, in Eastern N. E. must thoroughly understand hammer and drop forge work and designing dies for same; also treating tool and high carbon steels in all machine shop conditions, and in machine parts of a high order; no person will be considered who is over 45 and has not had charge of of such a department; state experience fully and wages expected. Box 53, AMERICAN MACHINIST.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Job lot radiators, 12 1-2c. ft., S. M. York, Cleveland, O.

Book, Dies & Die Making, $1. J. L. Lucas, Prov. R. I.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

A mechanical engineer desires to handle and sell a good chain block on commission. Box 59, AM. MACH.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Schumacher & Boye, Cincinnati, O.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Wanted second-hand power press, equal to Farrel Foundry manufacturing; no less then 21 inch stroke. Reply to Dunham Machine Works, Danbury, Conn.

Something new and reliable in the way of nut lock; cheap and effective; manufacturers should investigate; cannot come off until taken off. Write for terms to Wm. H. Fossett, Picton, Col.

Lathes, planers, drills, milling machines, vises, also brass working machinery second-hand; must be modern and in first-class condition. C. C. Wormer Machinery Co., Detroit, Mich.

WATER POWER FOR SALE.

100 miles west of Chicago, on Chicago and Northwestern and Illinois Central Railways; stone buildings; 100 horse power now running; can have 400.

E. C. PARSONS, Dixon, Illinois.

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BUCK CAST BROS. STEEL

Pattern Makers' Gouges, Woodworkers' Chisels, Gouges, Turning Tools.
Send for Price List.
BUCK BROS., Millbury, Mass.

Industrial Manufacturing Novelties WANTED.

A well-known Austrian wholesale supply house will publish an 1898-99 edition of an Illustrated Catalogue and Price List of 20,000 copies. This firm wishes to include novelties likely to be in demand by manufacturing establishments of all sorts—by mines, railroads and on the farm—so that such novelties shall be the soonest made known and practically introduced.

The early transmission of offers of such industrial manufacturing novelties is requested; they are to be marked "TECHNIK, W. 20,000," and sent to the Advertising Agency of RUDOLF MOSSE, Wien I, Seilerstätte, 2.

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If you were to get a circular full of mistakes and ridiculous expressions, would you buy on the strength of it? Are you sure you don't send out that kind? If you want work in German that is right, write

HENRY HESS,
Newport News, Va.

Perhaps you can save money on your

GRAY IRON CASTINGS

and get just as good metal.

ISAIAH PAGE'S SONS IRON FOUNDRY,
ALBANY, N. Y.

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For MACHINISTS and ENGINEERS.

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By GARDINER D. HISCOX, M.E.
A book designed for the general information of everyone interested in this new and popular motive power, and its adaptation to the increasing demand for a cheap and easily managed motor requiring no licensed engineer.
Price, $2.50.

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By JOHN T. USHER, Machinist.
Second Edition. 257 Engravings. 322 Pages.
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By ROBERT GRIMSHAW, M. E.
Nearly 400 Pages. 222 Engravings.
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*,*Any of the above books sent free on receipt of price. Our large Catalogue, embracing works on every practical subject, also a special circular of any of the above books, mailed free on application.

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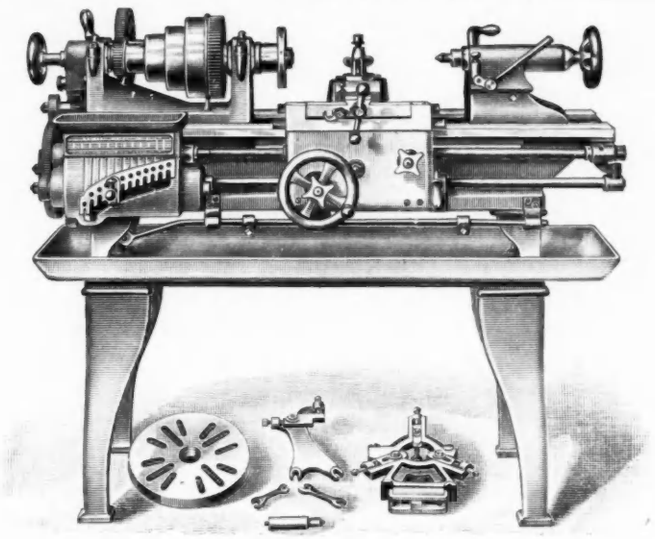
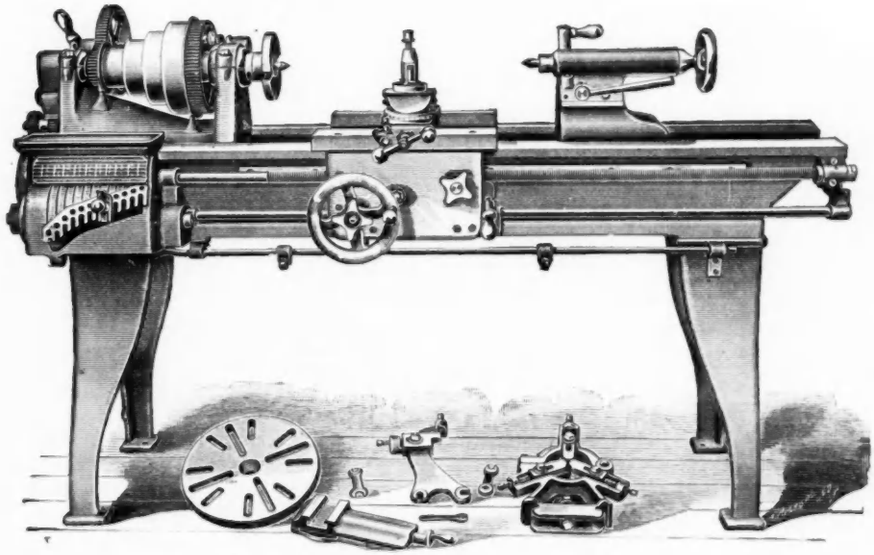
15 Beekman Street, NEW YORK.



12" Hendey-Norton Lathe

is fitted with drawing-in sleeve and American Watch Tool Co.'s standard chuck, used in making small taps, reamers, etc. Work finished first and cut from bar afterward. No centering required. See carriage reverse lever by right-hand side of apron ; no reaching for countershaft shipper required.



14" x 6' Hendey-Norton Lathe.

These lathes are modern, high-grade, practical tools, and are specially adapted for tool-room work. They have the Norton Attachment for screw cutting, giving 36 different threads and 36 different feeds with only two changes of gear and movement of lever in gear box from one notch to the other. Note the automatic stop under apron. It will automatically stop carriage at any desired point in either direction; invaluable for internal or duplicate work. SEND FOR CATALOGUE.

The Hendey Machine Company.

Torrington, Conn.

Agents for the Pacific Coast, Pacific Tool & Supply Co., San Francisco, Cal.
J. W. Cregar, Philadelphia Bourse Exhibition.

European Agents: Schuchardt & Schutte, Berlin, Vienna, Brussels, Stockholm.
Chas. Churchill & Co., Ltd., London and Birmingham, Eng.
Adphe. Janssens, Paris, France.
Eugen Soller, Basel, Switzerland.

Continued from page 40.

tract over to the General Electric Company for execution in America.

For street railway purposes in Louisville, Ky., has been ordered a generator of General Electric make, said to be the largest of the class ever built. It is a 75-revolution, 22-pole machine, of 2,400 kilowatts current—can be run up to 4,000 horse-power—height, 20 feet, total weight being about 90 tons, and that of the armature 45 tons. We surmise that an E. P. Allis engine plant will be installed to run it.

In the factory power transmission line it may be mentioned that there are two large manufacturing e tablishments in this district with which bids for furnishing electric motor equipments have just been put in, but the awards are not reported yet to have been given out. The generators for each concern have already been bought. One of them is the Arbuckle Sugar Refinery, of Brooklyn, which will install 750 horse-power of motors; the other, the car works of the John Stephenson Company, at Elizabethport, N. J., which will require from 450 to 600 horsepower, according to the system it adopts. The motors of the Arbuckle plant will be mostly belted, but the majority of those in the car works direct connected to the machines. A third establishment, the Long Island Sugar Refinery, has asked for descriptions of machinery from various manufacturers, and is expected shortly to frame specifications for an electrical power distribution plant, to be bid upon.

Among the few isolated lighting plants lately ordered for buildings in this city by far the most important is that for the thirty-story Park Row office building. The Westinghouse Electric & Manufacturing Company was the fortunate bidder, having been several hundred dollars below any other. Four hundred kilowatts of Crocker-Wheeler machines have been sold for instalment in the World Building, and 200 for the Hospital for the Ruptured and Crippled. Among orders expected to be placed with someone before long are those for the Melba Apartments and for the Judson Memorial Building.

The General Electric Company has been doing a very large business in arc lamps. During the year and a half since it placed the inclosed carbon arc lamp on the market the sales of these alone have amounted to about 24,000. The demand for transformers it finds also to be very good, which is owing in part to the fact that people are coming to recognize the economy of large transformers, and are installing them in place of small ones. The Fort Wayne Electric Corporation enlarged its meter department three times last year.

The Eastern office of the Walker Company informs us that it has found more business in the past three weeks than in

the preceding five months. During the last week it has taken several orders for power transmission plants of 500 horse-power and less. It has lately made some important export sales.

The C & C Electric Company has lately done considerable business in the West; for instance, around Seattle and Spokane. It has also taken some lighting dynamo orders for Youkon steamers.

Before leaving the subject of electrical machinery it may be well to mention that of late there have been rumors that the Manhattan Elevated Railway has contracted with either the General Electric or the Westinghouse companies to furnish electrical machinery to replace the present steam traction upon its lines. Although up to date no such arrangements appear to have been made, we should not be surprised to hear that at any time this transformation, which has been talked about for years past, has finally been decided upon. The Metropolitan Street Railway Company is progressing with its plans for the installation of electrical machinery, and we have reason to believe that it has recently contracted for 400 motor-car equipments, of General Electric make.

CINCINNATI REPORT.

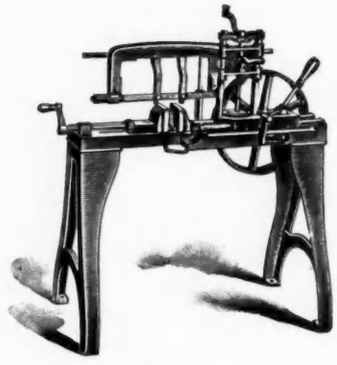
The last few months of 1897 were very encouraging to manufacturers of machinery and machine-tools here in the increased amount of business received. They found a great improvement over some of the previous years. For some of them last year's business was the largest they have done in the history of their respective firms. Thus far this year the indications are very bright. The Cincinnati Milling Machine Company is doing well this month, which is shown in many home orders lately received, as well as those from foreign lands; for instance, Denmark and Sweden. The Lunkenheimer Company refers to its business of 1897 as the largest it has had in its existence, covering a period of more than forty years. Extensive shipments made to South Africa are one indication of how its trade is extending. It has orders from many points in foreign lands, including Denmark, Sweden and Norway, from which countries more business is each year coming to American manufacturers. It has lately had many orders, showing a very fine increase in the home demand; in fact, its business for the month of January thus far is larger than it has ever had in the same month in any preceding year. R. K. Le Blond has marked an improvement in his business in the latter months of last year, not only in foreign trade, but in the increase of home orders. In this ordinarily dull month of January his business is holding on well. Dietz, Schumacher & Boye note a continued good business this month. They have within a few days made large shipments to England and points in Germany and to Rotterdam.

The

Q & C

Automatic

Shop Saw.



Special Machinery

For Cutting All Kinds of Iron and Steel Cold. . . . . .

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100 Broadway, NEW YORK, N. Y.

537 Mission Street, SAN FRANCISCO, CAL.

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Mechanical novelties and recent inventions; those specially adapted for working exhibits preferred, for

THE TWENTIETH TRIENNIAL EXHIBITION,

October and November, 1898,

Massachusetts Charitable Mechanic Association.

Address HENRY D DUPEE, Sec'y Exec. Com. Mechanics' Building, Boston, Mass.

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ARBOR PRESS

Saves marring, upsetting or springing the arbors and defacing or otherwise damaging finished work.

Saves cleaning out the centers and taking off the dogs.

Made in four sizes. Send for net prices.

Sold by

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PRESSES (FOOT AND POWER),

DIES AND OTHER TOOLS FOR SHEET METAL WORK.

NEW STYLES, IMPROVED DESIGN AND CONSTRUCTION. SEND FOR CATALOG.

FERRACUTE MACHINE CO., Bridgeton, N. J., U. S. A.

THE BENTEL & MARGEDANT COMPANY

MANUFACTURERS OF WOODWORKING MACHINERY

HAMILTON, O. U.S.A.

STAR FOOT POWER LATHES.

9 and 11 INCH SWING.

Screw-Cutting Engine Lathes with Automatic Cross-Feed, with or without Compound Rest Friction Countershaft, etc. Contain new and original Features. Especially adapted for **Tool-Room, Bicycle, Electrical** and **Accurate Machine-Shop Service.**

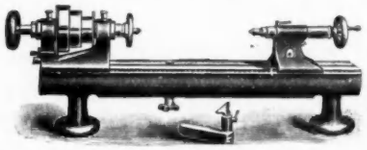
Send for Catalogue B.

SENECA FALLS MFG. CO.,

687 Water St., Seneca Falls, N. Y., U. S. A.

No. 3 Bench Lathe, 7 in. Swing, 32 in. Bed,

Is furnished without and with Thread Cutting, Filing and Milling attachments; Back, Jeweling Slide and Drill Rests; Graduating Head or Dividing Engine, Chucks, etc.



Hand Bench Milling and Profiling Machines; Sub-Press Bases and Stands with Dies.

Special attention given to Manufacturers' Models and Plants for Manufacturing on the Interchangeable System.

Ask for the Machinists' Catalogue.

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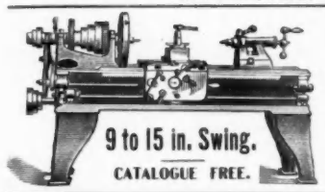
NEW YORK: 123 Liberty Street. BOSTON: 144 Pearl Street. CHICAGO: 42 South Clinton Street. LONDON, ENGLAND: Buck & Hickman, 280 Whitechapel Road. PARIS, FRANCE: Fenwick Freres & Co., 21 Rue Martel.



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IN VARIOUS LENGTHS—9 to 15 in. SWING.
Latest and Most Approved Designs. Workmanship, Material and Finish of the Highest Order.

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Agents: SELIG, SONNENTHAL & CO., London, Eng.; JOHN TRAGARDH & CO., Göteborg, Sweden; E. SONNENTHAL, JR., Berlin, Germany; R. S. STOKVIS & ZONEN, Rotterdam, Holland.

SLIDE VALVES.

A Book for Practical Men on the Principles and Methods of Design; with an Explanation of the Principles of Shaft Governors. By C. W. MacCORD, Jr., M. E. 8vo. Cloth. 168 pages and 101 illustrations. $2.00.

JOHN WILEY & SONS, 53 East 10th Street, New York City.

SUPERIOR QUALITY OF TAPPER TAPS.

ADJUSTABLE PLATE AND MACHINE DIES.
"Lightning" and "Green River" Screw Plates, Tap Wrenches, Reamers, Bolt Cutters, Drilling Machines, etc.

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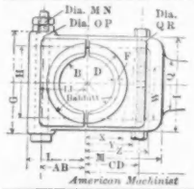
WILEY & RUSSELL MFG. CO., Greenfield, Mass., U. S. A.
Agents in London, SELIG, SONNENTHAL & CO., 85 Queen Victoria Street.



Proportional Drawings of Engine Details.

FOUR CORRECT MECHANICAL DESIGNS TO EACH SET.

Separate Sets for PISTONS, CROSSHEADS, CONNECTING RODS, CRANK SHAFTS, MAIN BEARINGS and WHEELS OF **MODERN HIGH SPEED ENGINES, 20 to 250 HORSE-POWER.**

One set of either part for $1.00; the complete six sets for $5.00.

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REDWOOD'S LUBRICANTS.

A book every engineer should have.
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BLUE PRINT STANDARDS OF MACHINE DETAILS
SEND FOR LIST OF SUBJECTS AND DESCRIPTION. FREE.
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IS the Perfection of Joint Packing. Instantaneous. **Does Not Squeeze Out** and not necessary to follow up joint. We guarantee it to last for years on any and all pressures of steam or any kind of joint where packing is required. Does not rot, burn or blow out, therefore the best for all purposes. Call for and insist on having **'96 JENKINS '96**, stamped like cut.

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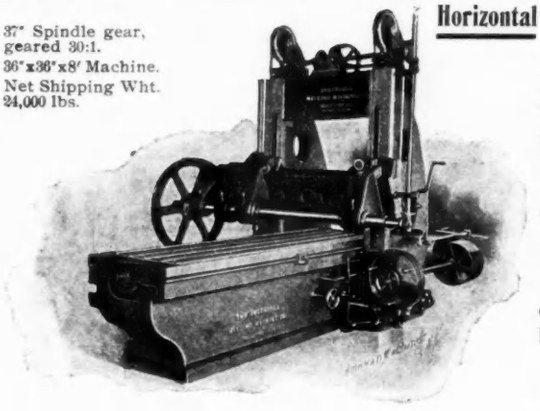
HEAVY MILLING MACHINES EXCLUSIVELY.

Horizontal or Vertical Spindles or Both.

37" Spindle gear, geared 30:1.
36"x36"x8' Machine.
Net Shipping Wht. 24,000 lbs.



SIZES:
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Wide range of cutter speeds.
Variable table feed from 3-16" to 10" per minute.
Power elevating and lowering device.
Table adjusted by power in either direction.

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126 Liberty Street, New York.
Cable Address: "Ingersoll," Rockford.

They report more doing in their home trade, and are kept very busy filling orders. Their new building has its roof on, and they hope to move into it in a few weeks. Of the foreign business of the Davis & Egan Machine Tool Company our readers already are aware. It may be added that their home trade is now increasing; that from England is also improving; a large order has just come from Amsterdam; trade with Norway and Sweden has fallen off, while in Russia, Germany and France it remains good.

▲ ▲ ▲

Quotations.

NEW YORK, Monday, January 31.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 75	@	$12 25
No. 2 foundry, Northern	11 00	@	11 50
No. 2 plain, Northern	10 75	@	11 25
Gray forge, Northern	10 25	@	10 50
No. 1 foundry, Southern	10 75	@	11 00
No. 2 foundry, Southern	10 25	@	10 50
No. 3 foundry, Southern	10 00	@	10 25
No. 1 soft, Southern	10 75	@	11 00
No. 2 soft, Southern	10 25	@	10 50
Foundry forge, Southern	9 75	@	10 00

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.07½ @ 1.10c.; refined, 1.15 @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some grades perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.45 @ 1.60c.

Cold Rolled Steel Shafting—Base sizes, from store, in small lots, about 2.20c.

Copper—Carload lots, Lake Superior ingot, 11c.; electrolytic, 10¾ @ 10⅞c.; casting copper, 10½ @ 10¼c.

Pig Lead—Carload lots, 3.60c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 13.90 @ 14.00c., f. o. b.

Spelter—Carload lots, 3.90 @ 4.00c., New York delivery.

Antimony—Fair wholesale prices on the various brands, 7¼ @ 8c.

Lard Oil—Prime city, present make, commercial quality, in wholesale lots, 42 @ 43c.

▲ ▲ ▲

Manufacturers.

The Lehman Machine Company, Williamsport, Pa., is to enlarge its plant.

At Erie, Pa., A. H. Deming contemplates the erection of a planing mill.

At Allegheny, Pa., the Pennsylvania Car Wheel Company is to erect a new factory.

At Anniston, Ala., the Anniston Pipe & Foundry Company's plant is being rebuilt.

The Portage Iron Company, of Duncansville, Pa., is now erecting a wire nail mill.

John T. Pela, of Jacks Mills, Va., contemplates the establishment of a new woolen mill.

The Huber Engine Company, of Harrisburg, Pa., is constructing a new machine shop.

It is rumored that the Illinois Steel Company is to erect a slab mill at South Chicago, Ill.

The Griffin Wheel Company, of Chicago, Ill., is having a new foundry erected, 50x300 feet.

Mr. Samuel Woodhouse, of Philadelphia, Pa., is contemplating the erection of a factory building.

At Charleroi, Pa., the Bamford Brothers Silk Manufacturing Company is to erect a new silk mill.

The Triumph Manufacturing Company, of Marion, Ohio, is expecting to make additions to its plant.

The Chas. Hillman Ship & Engine Building Company, of Philadelphia, Pa., is to erect a new boiler shop.

At Yankton, Ia., it is expected a starch factory will be erected. Mr. A. T. Beattie is largely interested.

It is expected that the New York Mills Company, of which S. R. Campbell is president,

may erect at Long's Station, Ga., a new bleachery and dye works.

At Connellsville, Pa., the Riverside Manufacturing Company expects to erect a new plant.

The King & Andrews Company, of Chicago, Ill., Heights, is to erect new buildings at a cost of $75,000.

The Dayton, Ohio, Ice Manufacturing Company is about to construct an addition to its present plant.

It is expected that the firm of J. M. & G. T. Brosins, of Terre Haute, Ind., will locate a plant at Adrian, Mich.

The plant of A. W. Stevens & Co., of Auburn, N. Y., is to be removed to a place near Menominee, Mich.

W. A. Richard and F. B. King have organized the Jackson, Mich., Machine Company and will use the old Bennett foundry.

The Weston Electric Instrument Company is preparing plans for the construction of a new power house at Newark, N. J.

The Davidson Pipe & Novelty Company has been incorporated at Detroit, Mich. It will engage in the manufacture of pipes.

The Keasbey & Mattison Company, of Ambler, Pa., has decided to enlarge its plant by the erection of a building 400x60 feet.

It is reported that the McKenna Company, of Milwaukee, Wis., is contemplating the erection of a new plant at Kansas City, Mo.

Fire visited the plant of the Atherton Machine Company at Paterson, N. J., recently, and damaged the machinery considerably.

The Imperial Steel Company, of Chicago, has been incorporated. F. C. Woodworth, Albert H. Putney and M. Bryant are the incorporators.

At Salem, Ohio, Mr. W. H. Brewer, of New Brighton, is contemplating the erection of a plant to engage in the manufacture of stoneware.

The Buckeye Engine Company, of Salem, Ohio, has been awarded a contract for four engines for the Post-Office building, Washington, D. C.

At La Crosse, Wis., the La Crosse Wallis Carriage Company is about to pass into new hands. The new corporation intends to place new machinery.

The Michigan Heater Company, of Detroit, Mich., has been incorporated. Frank Yannoth, Henry Beenm and Herman D. Keller are among the incorporators.

At Leechburg, Pa., the Hammar Manufacturing Company has erected a factory and will engage in the manufacture of novelties and general stamping work.

The Utica, N. Y., Steam Engine & Boiler Works Company has been incorporated. Joel A. Omens, J. B. Jones, H. S. Moore and H. C. Norton are interested.

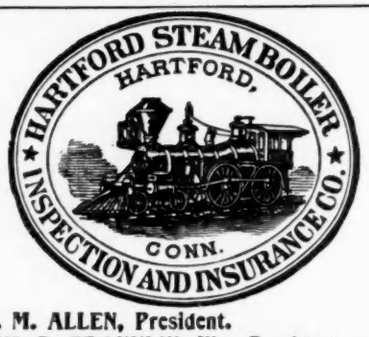
At Springfield, Ill., the Springfield Novelty Company has been incorporated. Wm. Schermerhorn, Ralph McCord and Albert W. Hillier are the incorporators.

At Massillon, Ohio, the Massillon Bed Spring Company has been incorporated. Wm. Scherdent; W. B. Humberger, vice-president, and H. C. Brown treasurer.

The Standard Buffing Machine Company, of Portland, Me., has been organized. Joseph Warren, of Boston, is president and Carleton E. Snow, of Everett, Mass., treasurer.

The Hart Ayres Manufacturing Company, of Brooklyn, N. Y., has been incorporated to manufacture motors, valves, etc. Charles Hart, of 531 Third street, Brooklyn, is interested.

Among the improvements now being made by the Benjamin Atha & Illingworth Company, at Harrison, N. J., is a new steel building known as the Tower Building. This building is 30 feet square and about 40 feet high; 35 feet above the ground is a circular trolley track carried by the roof trusses. The framework of the building is of steel throughout, and the siding and roofing of corrugated iron. The complete contract for furnishing and erecting this building has been given to the Berlin Iron Bridge Company, of East Berlin, Conn.



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Four years' undergraduate courses and special facilities for graduate work in all departments. Circulars forwarded, on application, to the Secretary of the University.

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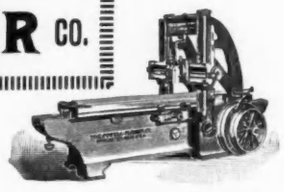

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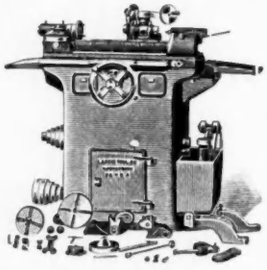

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8-INCH SWING, 20-INCH BETWEEN CENTERS.

Has no equal for finishing tools or parts of machinery, whether hard or soft. An abundance of water MUST be used to get the best results.

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costs but little and will grind all the tools for lathes, planers, etc., in a big shop. Saves time on every such machine. Ask about it.

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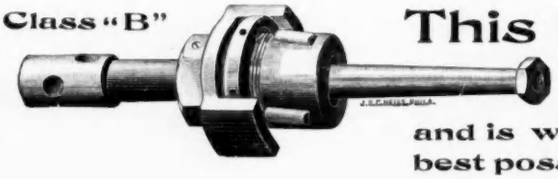

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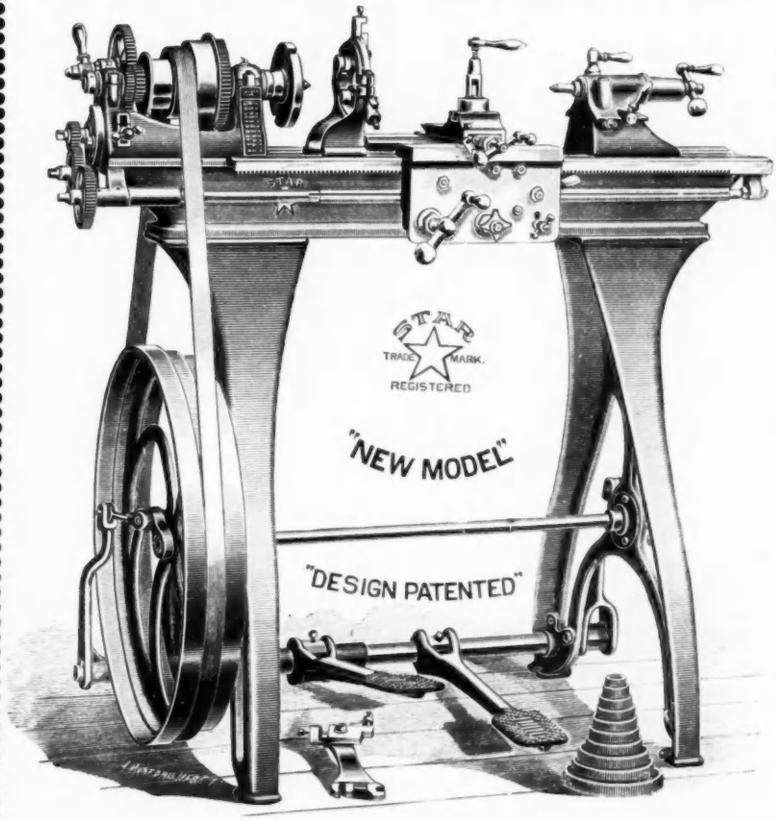

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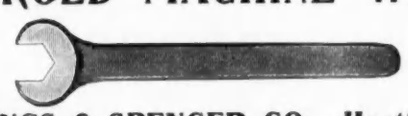

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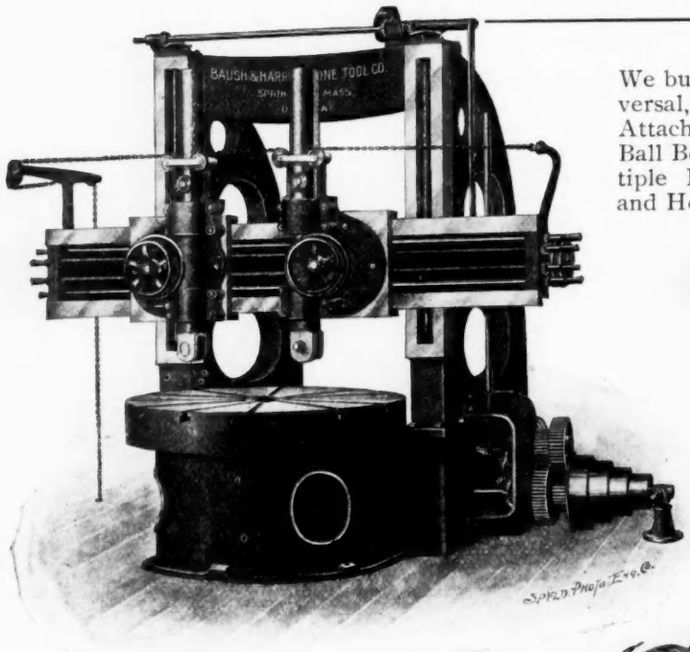

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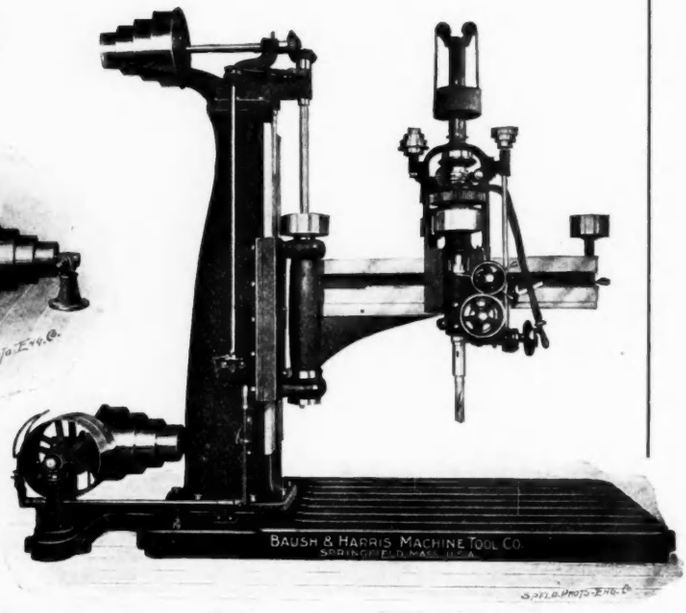

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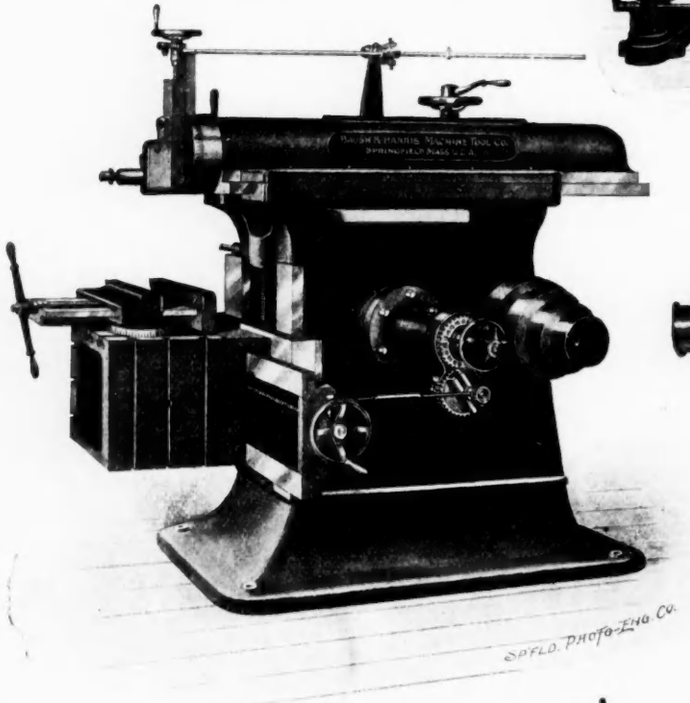

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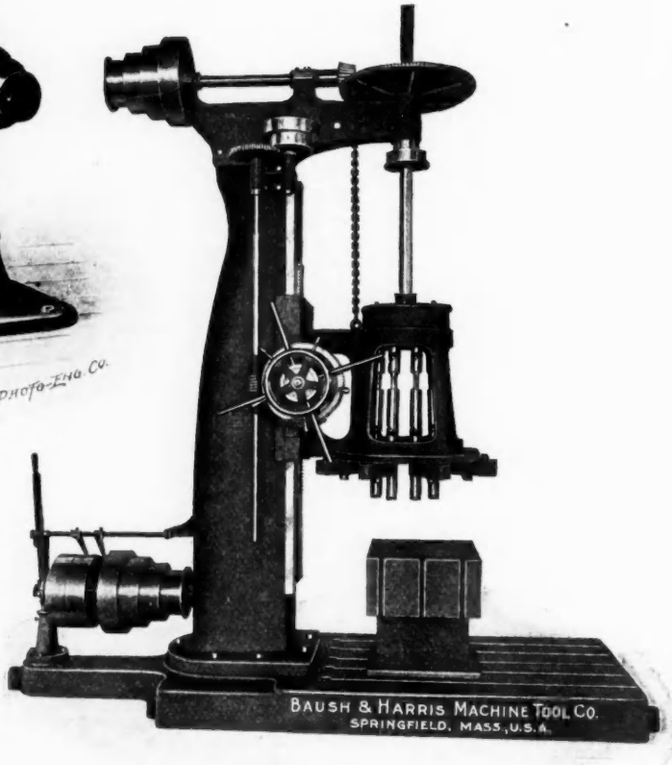

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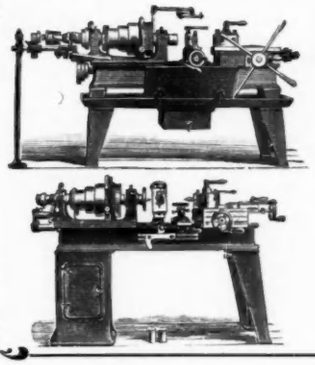

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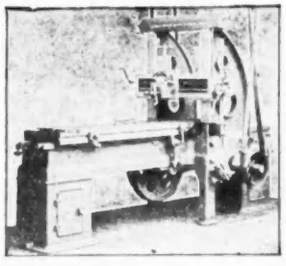

Fitchburg Planer 24-in. x 6 ft.

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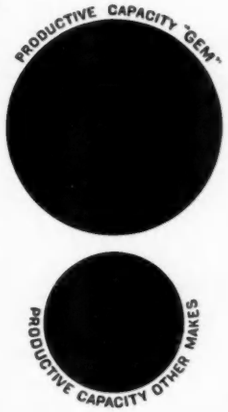
Send your orders now.



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(These are drawn exact size.)

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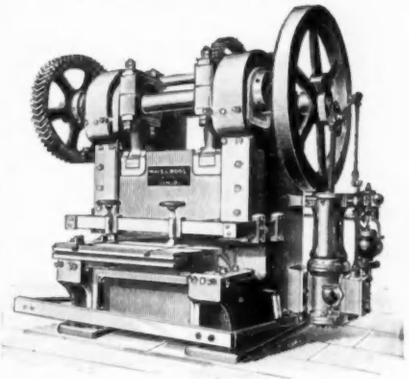

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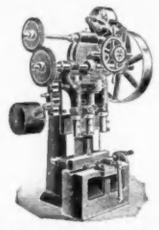
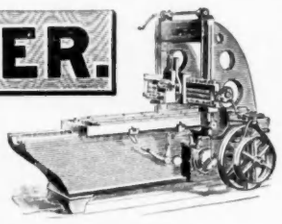


3-SPINDLE RAIL DRILL.

THE GRAY PLANER.



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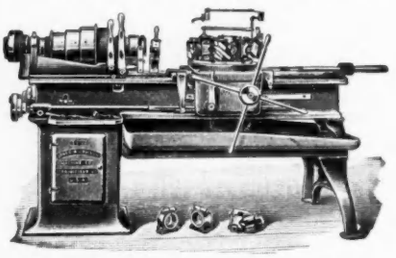

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that we inaugurated **THE MODERN SYSTEM** of automatically shaping and grinding **LATHE, PLANER** and other **TOOLS,** and that we invented the machines to do this work at an average wage cost of **LESS THAN 3-4 OF 1 CENT PER TOOL!** Illustrated pamphlet sent on request.

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Why not secure the maximum output from your hub machines?

"Constant Angle" Twist Drills, with holes for lubricant through solid metal, are the strongest and most durable drills for this work, admitting of perfect lubrication of the cutting lips. Their use aids in maintaining the highest productive rate from machines using drills of this type. Let us send you one for trial.

THE T. & B. TOOL COMPANY,

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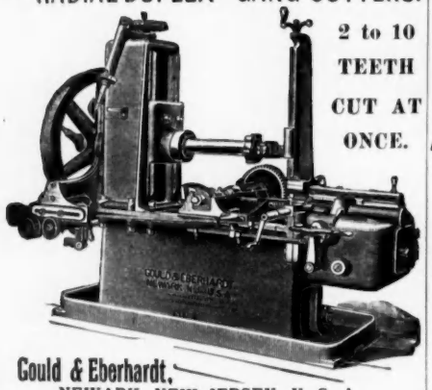

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GRANT GEAR WORKS,

125 South 11th Street, PHILADELPHIA.
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Gears up to 12 Feet Diameter.

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Mfrs. LATHES and GEAR PLANERS.
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Does Lathe work accurately up to 2 in. diameter by 24 in. long.

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Selling Agent for Germany, Switzerland, Austria-Hungary, Russia, Holland and Belgium: M. KOYEMANN, Charlottenstrasse, 112, Dusseldorf, Germany.

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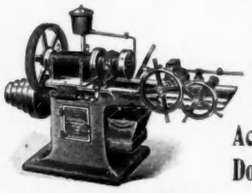
CLEVELAND, O.,



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Acme Bolt and Rivet Headers.

Acme Single, Double and Triple Automatic Bolt Cutters. *Cutting from 1-8 in. to 6 in. Diameter.*

Also Separate Heads and Dies.

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STANDARD AND SPECIALS.

CINCINNATI, O., U. S. A.

FOR ENGINES AND MACHINERY.

CRANES

PAWLING & HARNISCHFEGER,

163 Clinton St., Milwaukee, Wis.

Chicago Office: G. P. NICHOLS & BRO., Managers, 1325 Monadnock Bldg.

THE GILLETTE-HERZOG MANUFACTURING CO., Sole Agents Northwestern States. Minneapolis, Minn.

CLAYTON AIR COMPRESSOR WORKS

SEND FOR CATALOGUE: 26 Cortlandt St. NEW YORK.

A Visit to the Home of James Watt.

Birmingham, England, has many claims upon the interest of the engineer, but none is likely to be more impressive than the things one sees there that remind him of James Watt and of his scarcely less able partner, Matthew Boulton.

In Soho, which is included within the city limits, stood the famous workshop in which the first steps of the machinist's art as we now know it were taken, and in which engines were built that showed to the world how to make really practicable use of a source of power which has produced effects upon the human race so far beyond our computation that we can only dimly imagine what manner of life we should be leading to-day without it.

In that part of Birmingham known as Heathfield stands the house in which Watt lived during the later period of his life; after his earlier and very severe struggle with engineering and business difficulties, aggravated by his own delicate physical condition, had been surmounted, and he was able to enjoy in peace some of the fruits of his long and severe labors.

I experienced the pleasure of a visit to this house one day last spring. It stands in what is virtually a small private park, and when Watt lived there must have been, as it is now, a very attractive place of residence.

In an upper rear room of this house was Watt's den, in which he spent most of his time with his tools and in experimenting upon the solution of various mechanical problems. The room stands to-day practically as Watt left it when, in 1819, he died. I was permitted to explore this room and present herewith a reproduction of a photograph of it, for which photograph I am indebted to Mr. Harry Tangye, whose home is with his father in this house. By him it was taken from a point near the door leading into the room and looking toward the only window in it. In front of this window and where, as he worked, he had before him a view of luxuriant and well-kept shrubbery, stood Watt's work bench, and in other parts of the room were various machines of his own construction and his foot lathe, all with the tools lying about as Watt left them.

For some time previous to his death Watt was interested in the problem of producing a machine for copying sculpture, carvings, busts, medallions, etc., and two of these machines, built by him, appear in the picture. In the middle-ground is seen the smaller one of these, resembling a foot lathe somewhat, but with two pairs of index centers placed across the bed. In one of these centers the carving or cast to be copied was placed, while in the other was the work to be carved. Upon the former a finger, attached to a hinged lever above, was moved about, while a small cutter attached to a spindle, also supported by this lever, reproduced the motion of the finger upon a smaller scale, and thus gave a reduced copy in the other pair of centers. The wheel, belt, idlers and belt-tightening device are plainly indicated, and it is clear that, by indexing the model

JAMES WATT'S PRIVATE LABORATORY.

and work similarly by means of the index plates and following the contour in each position, exact duplicates could be made, and by shifting the index centers upon the bed to various distances apart the reduction could, of course, be to any desired scale within the limits of the machine.

The machine at the left is a more elaborate construction for the same purpose, but is incomplete. I believe it is not known whether Watt had completed it and had partly dismembered it afterward, with a view to making changes, or whether it had never been completed.

In the background are shelves containing jars for Watt's chemicals; he was interested in chemistry also.

The ceiling of this room slopes at the corners on three sides, owing to the fact that it approaches closely to the roof. It must have been rather a warm workshop in summer time and a cold one in winter; but Watt evidently loved it, and just outside the door, at the head of the stairway, is the small shelf on which things he might want were deposited and left until he chose to open the door and get them; for he would permit no intrusion within this room when at work in it.

As is apt to be the result of a visit to an historically interesting spot, this visit to Watt's home has led me to a renewed study of his life and achievements, and to a more vivid realization of a few leading facts that are often obscured and sometimes lost sight of.

It is not the fact that Watt's attainments in the work of improving the steam engine were the results of an incidental job of repairing a model of an engine, and that the same thing might have occurred to any other good and intelligent mechanic to whom the job might have been given. Watt had been for years preparing himself for just the work he finally accomplished. This preparation was an unconscious one, because Watt could not have known in advance much, if anything, of the nature of the problems he was finally to solve, and the solution of which was to give him immortal fame. But he was an ardent student of the physical sciences, and when he had a small shop in one of the buildings of Glasgow University, in which he constructed and repaired instruments, he made this shop a rendezvous for the professors of the institution, who found great pleasure and mental stimulus in conversations with him on scientific subjects. By this previous study, which seems to have been prompted only by the love of study and a natural desire to understand the why and wherefore of things, he prepared himself for his great work. Had not Watt undertaken to repair the model of a Newcomen engine he might never have given us the modern form of that machine; but he would almost certainly have made his mark in some other way, and, on the other hand, all the jobs of engine-model repairing that could be imagined, placed in the hands of ignorant, thoughtless and unprepared men, would never have led one of them to improve the steam engine as Watt improved it. The lesson of Watt's life seems to be that no genuine thinking is likely to be thrown away, and that, though it is true that the equipped man *may* never be able to rise to eminence, because the favorable opportunity may not present itself to him, yet all the opportunities in the world will never make eminent the one who is unprepared to make use of them.

It is doubtful, however, if Matthew Boulton is by the general public given his fair share of the honor attaching to the achievements of the firm. Watt's health was delicate; he was greatly troubled with almost constant headaches, and he had anything but a hopeful nature. His letters, written to Boulton during periods when Watt was away, setting up or looking after engines, show that he took the gloomiest possible view of everything connected with the business. Their debts troubled him and he worried about them. Mine owners, for whom the firm had installed pumping engines and had thereby rendered profitable what would otherwise have been utterly useless mines, tried by every manner of means to evade payment of the agreed upon royalties, and this was another cause of worry for Watt, and inspired many a doleful letter, which Boulton had to read, answer in such a way as to encourage Watt as much as possible and at the same time conceal from him his own anxiety regarding the very large and, at that time, rapidly growing indebtedness of the firm; a burden of debt, in fact, which seems to have been at times very near the point of swamping the enterprise.

Boulton not only possessed the original capital and the credit which were necessary to success, but he was a persistent worker; he never gave up; he was a good manager for their workshops; was well liked by the men who worked in them, and had the faculty of making a favorable impression upon all classes of men and of gaining their good will.

Boulton himself also did some creditable things in a mechanical way. He greatly improved the art of coining, and installed in Soho a plant of coining machinery that was much better than any that had preceded it. Without Watt Boulton would still have been a successful manufacturer and an honored and useful citizen; and perhaps the best evidence of his ability is found in his clear perception of the genius of Watt, his steadfast faith in his final triumph, and in the fact that he was able to rise above minor difficulties and struggle on through weary years to a final complete success for both of them.

Among the other trials that had to be borne by the struggling firm were the desperate efforts made to have Watt's patents declared void by the courts or by Parliament. These efforts finally failed, but added much to the burdens under which Boulton & Watt struggled. We find Watt writing to Boulton during this period, as follows:

"They charge us with establishing a monopoly; but if a monopoly, it is one by which their mines are made more productive than ever they were before. Have we not given to them two-thirds of the advantages derivable from its use in the saving of fuel and reserved only one-third to ourselves; though even that has been still further reduced to meet the pressure of the times? They say it is inconvenient for the mining interests to be burdened with the payment of engine dues; just as it is inconvenient for the person who wishes to get at my purse that I should keep my breeches-pocket buttoned. It is doubtless also very inconvenient for the person who wishes to get a slice of the squire's land that there should be a law tying it up by entail. Yet the squire's land has not been so much of his own making as the condensing engine has been of mine. He has only passively inherited his property, while this invention has been the product of my own active labor, and of God knows how much anguish of mind and body!"

There can be no doubt that many of the methods that are to-day followed in machine shops, especially those in which engines are constructed, were first developed in this shop of Boulton & Watt's. Of most of these there is no record; there were no "American Machinists" in those days. But Smiles, in his "Lives of Boulton and Watt," relates how some sal-ammoniac and iron borings had become accidentally mixed in the tool chest of William Murdock and badly rusted his saw blade. Instead of simply seeing to it that that particular combination was not again formed in his tool chest, as most men would have done, he immediately saw the possible usefulness of it, made some experiments and developed the cement which is to-day largely used for bedding engines and making joints of various kinds required in machine construction. Murdock was probably their best man, and, besides being an excellent workman, was himself an inventor. The invention of the D-slide valve is attributed to him, and he also conceived and first carried out the idea of lighting houses by means of gas carried through pipes.

At Handsworth Church, near the house in which Watt lived, Boulton, Watt and Murdock are buried, and here is a magnificent statue of Watt. Previously, on Easter Sunday, I had visited Westminster Abbey and had there seen the statue to Watt, which bears the famous inscription composed by Lord Brougham, and which

is generally considered to be the finest lapidary inscription in the English language. It is printed below. F. J. M.

Not to perpetuate a Name
Which must endure while the Peaceful Arts flourish,
But to show
That Mankind have learned to honour those
Who best deserve their gratitude,
THE KING,
His Ministers, and many of the Nobles
and Commoners of the Realm,
Raised this Monument to

JAMES WATT,

Who directing the Force of an Original Genius
Early exercised in Philosophic Research
To the Improvement of

THE STEAM ENGINE,

Enlarged the Resources of his Country,
Increased the Power of Man,
And rose to an Eminent Place
Among the Illustrious Followers of Science,
And the real Benefactors of the World.
Born at Greenock, 1736.
Died at Heathfield, in Staffordshire, 1819.

▲ ▲ ▲

That Patent Experiment.

BY FRANK RICHARDS.

Those who read my account of "A Patent Experiment," in the "American Machinist," January 27, will doubtless be interested in the following letter. The coincidence of dates is remarkable, and the bland confidence of method displayed is perhaps not less so. The italics are mine. It will be remembered that this firm reported as patentable a patented invention of mine more than thirty years old. This is also the firm which charges 50 cents for a 5-cent copy of a patent "if only the name of the inventor and date of the patent are known":

Mr. F. H. Richards.

Dear Sir:

You wrote us some time ago about a patent, and we have carefully preserved your correspondence, because should another claim the invention it will be good as evidence to prove that you are the first inventor, and alone entitled to the patent. * * * It will, however, be useless for us to keep the correspondence if you do not intend to apply for a patent.

Allow us in this connection to say that we, in the belief that you intended to apply for a patent, *made a careful preliminary examination* and that other attorneys charge $5 for this service. * * *

We will be glad to know your intentions with regard to your invention, and if you will make a small remittance, even if it is not more than $3, as an earnest of your intention to proceed, we will keep your papers on file, and when you are ready to apply for a patent the amount you remit will stand to your credit.

We will be glad to hear from you, and remain. Yours truly,

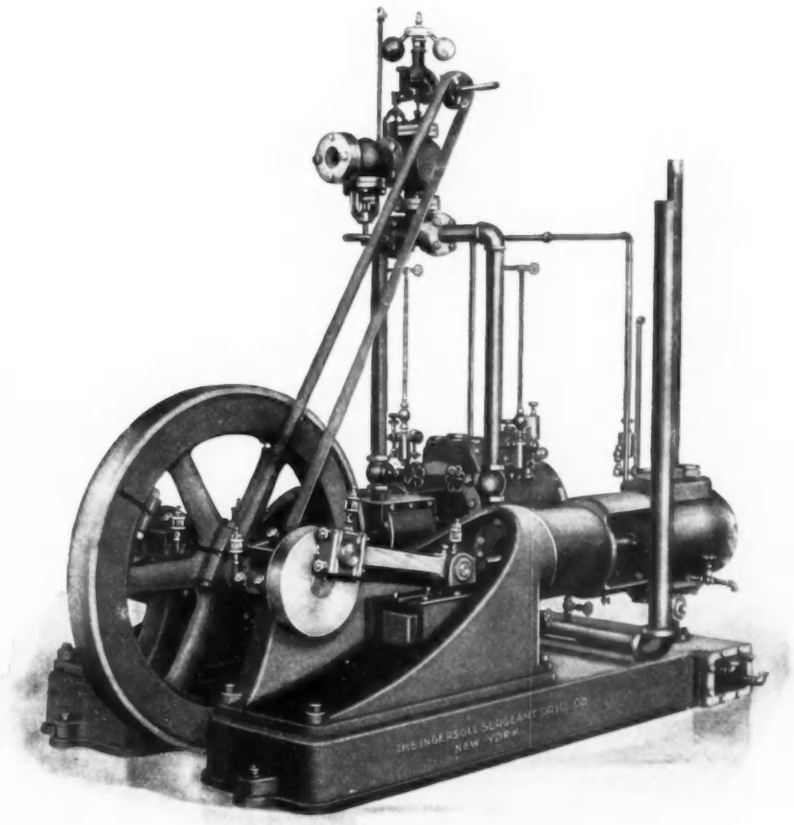
C. A. SNOW & Co.

Washington, D. C., Jan. 27.

Automatic Steam Driven Air Compressors for Shop Service.

We illustrate one of the latest styles of air compressors made by the Ingersoll-Sergeant Drill Company. It has been especially designed for use in shops and factories, where it is now becoming almost imperative to maintain a constant supply of compressed air. The use of the air in shops may be said to be always intermittent and irregular, so that no satisfactory service can be obtained from a constantly running machine. Devices that simply stop the steam driven compressor when the pressure rises to a given point, and start it again when the pressure falls two or three pounds, are open to the serious objection that while they guard against high pressures they do not prevent the compressor from running away when the pressure falls too low. The present machine is reliably automatic in its action against either high or low pressures. A pressure actuated throttle valve takes care of the compressor when the pressure rises to the allowed limit, and the ball governor prevents the machine from running above its permitted speed when the pressure falls.

The machine, as will be seen, is compactly arranged, and is entirely self-contained. The steam cylinders, 8 by 8 inches, connect to cranks set at 90 degrees, so that there is no dead center. The air compression is two-stage, with an effective intercooler between, thus securing the most economical application of the power employed and avoiding the high temperature at delivery, and the possibility, to which attention has recently been called in our columns, of dangerous explosions by ignition. The air compressing cylinders, which are water jacketed, are placed one tandem to each steam cylinder, the smaller or high pressure cylinder being in the view here given, the one near the observer. These cylinders are respectively 14 inches and 9 inches diameter, with the same stroke, 8 inches, as the steam cylinders. The tubulous intercooler is contained in the base of the machine. The normal speed of the machine is 150 revolutions per minute, and the free air capacity is 210 cubic feet per minute. With ordinary steam pressure the air may be carried up to 100 pounds, gage. A line of these compressors is made, with steam cylinders from 6 by 6 inches to 12 by 12 inches, and air cylinders from 6 by 6 inches to 18 by 12 inches with free air capacities from 50 to 1050 cubic feet per minute, and for pressures ranging from 10 to 125 pounds.



AUTOMATIC STEAM ACTUATED TWO STAGE AIR COMPRESSOR FOR SHOP SERVICE.

Commercial Review.

NEW YORK, Saturday Evening, Jan. 29, 1898.

In the electrical machinery line, the demand continues most excellent. Several companies seem to be busier even than they were at the end of the year, which is saying considerable. Two concerns find it a little duller in new orders, but it so happens that one of these is still running its shop twenty-two hours a day and the other was on extra time until a week ago, and expects to return to it about February 15. If that is what dullness means we should like to see a little more of it. One company which was on night time before the holidays is now endeavoring to squeeze even more work out of its plant than in December. "In old times," remarks one of its representatives, "when a man came to us to buy a 1 horse-power motor we could hand it down from the shelf. Now we have to make him wait three weeks for it, and if he is not in too great a hurry, five weeks. We are crowding hard upon our supply people—'We want that copper right away,' 'When will you get that wire ready for us?'" One reason why factories are now so busy is said to be that they allowed their stocks to run down during the times of depression.

LIGHTING, POWER AND RAILWAY MACHINERY.

Coming now to speak of what is being done, has lately been done, or is contemplated in these three lines specifically, we may premise that they are all pretty good. It is, however, a between-seasons time in lighting, and consequently some companies who handle both motors and lighting generators notice that the former are more in demand. In railway work some large orders have come in, both at home and from abroad. The news that the General Electric Company is to build thirty-two electric locomotives for the Central London Underground Railway was noted in our columns last week. This order was included in the original contracts between the railway and the British Thompson-Houston Company for the equipment for the road, but it has been supposed previously that these locomotives would be built in England. The latter company has now turned the con-

Continued on page 41.

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Business Specials.

Gear wheels, gear cutting. Grant; see page 20.

Power hammers, Jenkins & Lingle, Bellefonte, Pa.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Conn.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

▲ ▲ ▲

Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

Experienced mech. draftsman, BOX 54 AM. MACH.

First-class draftsman and designer, tech. graduate, with six years' best exp. Box 37, AM. MACHINIST.

Mech. draftsman and mchst.; exper. steam, marine pump, gen mach.; desires position. Box 18. AM. MACH.

A good mech. draftsman wishes position. Address G. W., care of A. Warth, No. 40 Second Street, N Y. city.

Thoro'ly prac. d'ftsman and designer; 3 years' shop exp., 5 years d'fting, desires a change, Box 57, AM. MA.

A graduate from a technical institute in Germany, also experience as a draftsman, desires a position. E. S. B., Room 46, 156 Broadway, New York.

Young man desires change; wants situation as machinist and pattern maker; can also do drafting; best of reference. Box 58, AMERICAN MACHINIST.

First-class draftsman and mechl. engineer; 20 years' varied exp.; designer of high-grade eng., etc.; open for eng. Address Box 10, Painted Post, N. Y.

Pattern maker, first-class and practical, wants a position as foreman; experienced on engine and general machine work. Box 49, AMERICAN MACHINIST.

Wanted—Situation as foreman, supt. or master mechanic, by a first-class mechanic of experience and ability; best of reference. Box 56, AM. MACHINIST.

Situation wanted by draftsman and designer; 9 yrs'. experience; automatic machinery, tools, engines, boil. ers, and use of steam eng. indicator. Box 44, AM. MACH.

A practical, up-to-date foundryman desires position as foreman, familiar with heavy and light mach'y engine and boiler castings, chilled and sand rolls; good habits, good references. Box 50, AM. MACHINIST.

Situation wanted as foreman, master mechanic or any capacity requiring the services of a first-class mechanic; exp. in marine and stationary work; vicinity of New York preferred. Box 32, AM. MACHINIST.

Experienced man on design construction, erection, and repairs of engs., boilers, mechanical stokers, small loco. and coal mine mach., wants to change; cannot consider sal. below $100 per. mon.; age 35. Box 52, AM. MACH.

Situation wrnted as machine shop foreman or toolmaker by practical mechanic; 10 years' experience on new inventions and interchangeable system; very successful in past; best of references from last and previous employers; habits strictly sober. Box 61, AM. MA.

Engineer, 32, thorough tech. education; member A. S. M. E.; splendid experience as constructing eng. and manager, desires change; knows modern methods of mach. designing and shop practice; immense exp. on construction Corliss and other engs., air compressors, ice mach. and the most improved gas eng. practice; competent to assume charge of works of any magnitude; pos. as gen. supt. or chief eng. wanted; highest testimols. from all past employers. Box 20, AM. MACH.

Help Wanted.

Wanted—German speaking mechanic suitable for salesman in machinery line. Foreign, AM. MACH.

Wanted—A good draftsman on high speed eng's; one familiar with foundry work preferred. Box 51, AM. MA.

Wanted machine shop foreman accustomed to high speed engine work; state fully experience. Box 60, AMERICAN MACHINIST.

Wanted—A young man as foreman of die room drop forging; an unusual opportunity with an old concern for a strictly first-class man. Box 55, AM. MACHINIST.

Wanted—An A No. 1 draftsman with experience in locomotive work as well as general machinery; a good salary to competent party; location in Ohio. Address Locomotive Draftsman, care AM. MACH.

Mechanic capable of designing small tools, jigs and special machines for large plant, and competent to take full charge of department doing this class of work. state experience and references. Address Beans, care of the AMERICAN MACHINIST.

Wanted—First-class working foreman for blacksmith, hardening and tempering department, in Eastern N. E. must thoroughly understand hammer and drop forge work and designing dies for same; also treating tool and high carbon steels in all machine shop conditions, and in machine parts of a high order; no person will be considered who is over 45 and has not had charge of of such a department; state experience fully and wages expected. Box 53, AMERICAN MACHINIST.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Job lot radiators, 12 1-2c. ft., S. M. York, Cleveland, O.

Book, Dies & Die Making, $1. J. L. Lucas, Prov. R. I.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

A mechanical engineer desires to handle and sell a good chain block on commission. Box 59, AM. MACH.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Schumacher & Boye, Cincinnati, O.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Wanted second-hand power press, equal to Farrel Foundry manufacturing; no less then 21 inch stroke. Reply to Dunham Machine Works, Danbury, Conn.

Something new and reliable in the way of nut lock; cheap and effective; manufacturers should investigate; cannot come off until taken off. Write for terms to Wm. H. Fossett, Picton, Col.

Lathes, planers, drills, milling machines, vises, also brass working machinery second-hand; must be modern and in first-class condition. C. C. Wormer Machinery Co., Detroit, Mich.

WATER POWER FOR SALE.

100 miles west of Chicago, on Chicago and Northwestern and Illinois Central Railways; stone buildings; 100 horse power now running; can have 400.

E. C. PARSONS, Dixon, Illinois.

WOODWORKERS

BUCK BROS. CAST STEEL

Pattern Makers' Gouges, Woodworkers' Chisels, Gouges, Turning Tools.
☞ Send for Price List.
BUCK BROS., Millbury, Mass.

Industrial Manufacturing Novelties WANTED.

A well-known Austrian wholesale supply house will publish an 1898-99 edition of an Illustrated Catalogue and Price List of 20,000 copies. This firm wishes to include novelties likely to be in demand by manufacturing establishments of all sorts—by mines, railroads and on the farm—so that such novelties shall be the soonest made known and practically introduced.

The early transmission of offers of such industrial manufacturing novelties is requested; they are to be marked "TECHNIK, W. 20,000," and sent to the Advertising Agency of RUDOLF MOSSE, Wien I, Seilerstätte, 2.

CATALOGUE TRANSLATIONS.

If you were to get a circular full of mistakes and ridiculous expressions, would you buy on the strength of it? Are you sure you don't send out that kind? If you want work in German that is right, write

HENRY HESS,
Newport News, Va.

Perhaps you can save money on your

GRAY IRON CASTINGS

and get just as good metal.

ISAIAH PAGE'S SONS IRON FOUNDRY,
ALBANY, N. Y.

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For MACHINISTS and ENGINEERS.

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By GARDINER D. HISCOX, M.E.
A book designed for the general information of everyone interested in this new and popular motive power, and its adaptation to the increasing demand for a cheap and easily managed motor requiring no licensed engineer.
Price, $2.50.

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